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**ECONOMIC ANALYSIS REPORT - COMPARATIVE
ADVANTAGE FOR SUPPLY MANAGED COMMODITIES**

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**ECONOMIC ANALYSIS REPORT –
COMPARATIVE ADVANTAGE FOR SUPPLY MANAGED
COMMODITIES
(PROJECT # 20040719)**

**FOR
SASKATCHEWAN AGRICULTURE, FOOD
AND RURAL REVITALIZATION**

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1.0 EXECUTIVE SUMMARY

Consumers in Canada, historically, have not been overly concerned about the availability or the quality of the food that they require. However, this may be changing as consumers become faced with food choices that are impacted by events such as BSE, avian flu and other influences. While food quality is, and likely will continue to be, increasingly scrutinized, concerns about availability have as yet not really materialized. It is within the realm of possibility for a given province in Canada to have a disease outbreak severe enough so as to result in a province wide moratorium on production of a given sector, chickens for example. Especially in a given province that has historically experienced significant growth in production; the net result being a certain intensity and relative close proximity between production units.

Expansion within the sectors of dairy, eggs, chickens and turkeys is limited by the availability of quota that is regulated within provincial systems; supply management. Traditionally, quota allocation within Canada has favoured historic patterns of percentage increases and population changes.

The Farm Product Agency Act, the Act that governs supply managed production, defines five criteria that are to be applied to process of allocating quota, one of which is the economic principle of comparative advantage.

Comparative advantage is an economic theory that explains why and how trading economies (such as provinces or territories within Canada) specialize in certain industries. Comparative advantage benefits all participants, provided that each trading economy (province) specializes in the industry in which its resources and capabilities are most efficiently used, and trade their outputs with other economies (provinces). Comparative advantage results in producing the greatest volume of goods in total and maximizes the consumption of all consumers in the economies for their net benefit.

While comparative advantage has been considered in quota allocation negotiations, it has not actually been factored into allocation outcomes, primarily because of the difficulty in quantifying its impact.

Comparative advantage actually exists in Saskatchewan, due mainly to the province's vast abundance of land ideally suited for primary and secondary agricultural production. The large land base and thin population creates comparative advantage of production for various production factors such as abundance of feed grains, bio-security and land application of manure. Urban pressures for land in Saskatchewan are minimal thus enhancing the province's comparative advantage due to low opportunity cost of using land for agricultural purposes. Higher value alternatives do not compete for land to the same extent as in other urban pressured areas of Canada such as Ontario and Quebec.

The existence of comparative advantage of production in Saskatchewan is evidenced through a proxy industry analysis of the development and growth that has occurred in the hog industry.

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Because of the similarities between different types of intensive livestock operations, one can conclude that the comparative advantage of production that exists for hog production would also exist for supply managed intensive livestock industries.

The existence of comparative advantage is also evidenced through a direct comparison of the egg industry between Canada and the United States. Under the assumption that Canada and the United States share similar production environments, one can conclude that under a similar environment lacking policy intervention, Canada's egg industry would have grown similarly to the American industry. For example, Michigan's egg industry has declined since 1978 while Nebraska's industry has experienced substantial growth. Considering the similarities between Saskatchewan and Nebraska and Michigan and Ontario, one can conclude that egg production in the Canadian provinces would have followed the development patterns of their companion American state. Accordingly, the growth patterns within the sector in the United States can be attributed to comparative advantage and the related factor endowments utilized in egg production and abundantly, and similarly, available in Saskatchewan and Nebraska.

Although comparative advantage is most often referred to within open market assumptions, it can also be applied to production and markets that are influenced by government policy; specifically supply management. Using egg production growth data based on the American egg industry, an econometric analysis indicated that grain production and intuitively land availability were factors in determining the growth of American egg industry. Using this information, it is possible to develop a framework within the supply management system that awards quota based on comparative advantage of production considerations.

Failing to apply all the criteria associated with quota allocation within the supply-managed sector could ultimately threaten the very people whose best interests are being respected; namely the consumer and producers. Allocation of additional of supply-managed quota in Canada should in the future, more actively consider the criterion of comparative advantage.

2.0 INTRODUCTION AND BACKGROUND

Current agricultural policies dictate that Saskatchewan's production of dairy, eggs, chickens and turkey is regulated through Canada's supply management legislation. Production is regulated by provincial quota limiting the amount of these products that each province can supply to the domestic market. The Federal and Federal/Provincial agreements that provide the basis upon which quota is allocated have traditionally awarded additional quota to provincial jurisdictions according to patterns of historical marketing and/or population changes. These measures, however, are not the only measures that are to be used in the allocation of additional quota according to the legislation.

Comparative advantage is an economic theory that attempts to explain why and how trading economies (such as provinces or territories within Canada) specialize in certain industries. Comparative advantage benefits all trading participants, including consumers, providing that



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each trading economy (province) specializes in the industry in which its resources and capabilities are most efficiently used, and trade their outputs with other economies (provinces). Comparative advantage results in producing the greatest volume of goods in total and maximizes the consumption of all consumers in the economies.

As stated in the federal *Farm Product Agencies Act (FPA)* Section 23(2):

23(2) In allocating additional quotas for anticipated growth of market demand, an agency shall consider the principle of comparative advantage of production.

The above statement would suggest that national supply management agencies such as Canadian Egg Marketing Agency and the Canadian Turkey Marketing Agency for example are required to allocate the national quota, in response to actual and anticipated growth of market demand, among provinces in part by considering the principle of comparative advantage.

There are 5 criteria of the FPA that the national supply managed agencies are required to take into account when allocating quota. The first is *the principle of comparative advantage of production*. The quota should be allocated according to the province that can most efficiently use its resources and capabilities, to maximize total output and Canadian consumption.

The second criterion states that supply managed agencies are required to take into account *the variation in the size of the market for the commodity*. This means that an agency, such as the Canadian Egg Marketing Agency, needs to understand the growth of market demand of eggs.

The *failure of any province(s) to produce* is the third criterion that national supply managed agencies is required to take into account. This suggests that in the event that any given province could not fill the production quota, the concept of comparative advantage is overlooked. The Avian Flu epidemic is a good example. If production in British Columbia were to be affected there could result in consumer supply issues. However, in this example, Saskatchewan could realize comparative advantage when compared to British Columbia in terms of a production biosecurity perspective, given the favourable density of production in Saskatchewan. The study will include an examination of this aspect of comparative advantage.

The fourth criterion to consider is *feasibility of production*. Feasibility of production takes into account the pure practicality of whether or not a provincial economy can take on an increase in production. For example, PEI may have comparative advantage in agriculture; however, the feasibility criterion would dictate quota allocation on a level that would be manageable for a region. Again, this study will examine the application of this aspect of comparative advantage as it relates to Saskatchewan and where, comparatively speaking, the limitation to feasibility of production does not exist.

Comparative transportation costs are the fifth criterion that supply agencies are required to consider. This is the difference in transportation costs between provinces and regions in Canada. Saskatchewan is advantaged in terms of specialization in primary agriculture where



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relative transportation costs to densely populated areas are less than the difference between production costs in Saskatchewan and other provinces. The principles of comparative advantage dictate that regions use resources most efficiently such that total output is maximized and consumers benefit. There is correlation between this dictum and the comparative relationship between transportation and production costs.

The principle of comparative advantage is included in agreements on quota allocation. However, many signatories feel that comparative advantage is theoretical and cannot be applied in a meaningful way to quota allocation decisions.

Saskatchewan Agriculture, Food and Rural Revitalization administration, and many others in the agriculture industry, believe that the province enjoys comparative advantage in supply-managed production. What is missing, however, is a functional method of applying this economic theory to the allocation of additional quota.

If Saskatchewan does not gain increases in the production of dairy, eggs, chicken and turkey through Canada's supply managed systems, in allocation patterns that take into consideration Saskatchewan's comparative advantage of production *and* that differ fundamentally from historical allocation, then alternatives will need to be examined if Saskatchewan intends to expand production in these agriculture sectors. One option to consider is accessing export markets for these products and as a means to justify and support production expansion. Under current trade rules, access to these markets is severely hampered through a system of regulatory and non-regulatory hurdles.

2.1 OVERVIEW OF PROJECT OBJECTIVES

There are three main objectives addressed within this report:

- 1) Develop a functional framework for quota allocation based on comparative advantage in the production of supply-managed goods.
- 2) Determine if a comparative advantage exists for Saskatchewan supply managed commodities relative to other parts of Canada and;
- 3) Identify regulatory and legal hurdles to the production of supply-managed commodities outside of the supply managed system for export and identify options for addressing those hurdles.

2.2 METHODOLOGIES AND COMPONENTS

- 1) The Study included a review of economics literature focusing on the definition of comparative advantage and relevant applied research.

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- 2) The Study reviewed and defined the term 'comparative advantage' with a purpose of understanding what comparative advantage 'is' and how it can be applied to the supply managed sector.
- 3) The Study compared and contrasted comparative advantage, competitive advantage; discussing the economic definitions of comparative and competitive advantage with the objective of clearly illustrating what differentiates comparative advantage from competitive advantage.
- 4) The Study included the development of a framework that could be used to allocate quota such that comparative advantage, as defined in the Act and the Federal Provincial Agreements, was being respected.
 - The methodology included an assessment of three approaches:
 - A review, analysis and consideration given to the applicability of how a non-supply-managed industry, that has similar attributes, has evolved. For example, what might the evolution of the hog industry in Canada suggest about the pattern that would have emerged in the feather industries (supply managed) in the absence of barriers.
 - A review, analysis and consideration given to the applicability of the evolution of a similar industry in a jurisdiction that does not have supply management. For example, an analysis of the US market for chickens may identify the factor endowments (land, environment, population density, etc.) that determine the pattern of development of that industry in the US. We will theoretically apply this analysis to what the Canadian industry would look like given the distribution of endowments within Canada, assuming that the same forces that determine production in the US would operate in Canada as well.
 - A review, analysis and consideration given to the applicability of the model used in Iowa State to address China's comparative advantage uses the Policy Analysis Matrix (PAM). This model has been used in various types of economic models including environmental costing models. PAM uses and I/O macro model to estimate "open market" or "social" prices for inputs and outputs. These are then used to consider the relative profitability of different types of production. Relative profitability under these fair market prices is considered to be an indication of Comparative Advantage. We will consider the application of factor endowments that exist in Saskatchewan. For example, if environmental concerns can be converted into social costs, they can be included in the PAM and their affect on the sustainability of an industry can be quantified.
- 5) The Study identified the mid and long term implications of implementation of each methodology.
- 6) The Study identified the key economic and environmental factors that would contribute to comparative advantage in the supply-managed sector.
- 7) The Study examined Saskatchewan's supply managed industry relative to other provinces, given certain economic and environmental factors.

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- 8) The Study identified policy and non-policy measures that could be taken that would enhance comparative advantage for supply management.
- 9) The Study reviewed regulatory and legal hurdles to the production of supply-managed commodities for export outside of the supply managed system.

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3.0 COMPARATIVE AND ABSOLUTE ADVANTAGE

Economic discussions, as they relate to the theory of comparative advantage of production, relate to a region's ability to produce and specifically involve the concept of factor endowments or factors of production. Factors of production are the resources that are the basic inputs used in the production of goods and products. Economists generally agree on the following three major categories of factor endowments:

- 1) Land – includes arable land, land used for cities and buildings, and “gifts of nature” that come from the land (natural resources).
- 2) Capital – buildings, equipment, and materials used in the productive process.
- 3) Labour – human resources. Includes the entrepreneurial spirit of individuals and their mental and physical talents that go into the production of goods and services

There are obvious and intuitive reasons why some countries or regions specialize in the production of a certain good. Specialization often occurs in regions that are best suited for the production of certain goods: wood products are produced in British Columbia, corn in Iowa, bananas in the tropics etc. This is the theory of absolute advantage.

A country (or region or individual) has an absolute advantage in the production of a good if it can produce that good with fewer resources (less land, labour and capital) than can other countries (or regions or individuals).

(Blomqvist, Wonnacott, Wonnacott, 1994)

If a region has an abundance of a certain factor endowment, it is intuitive to assume that region would specialize in the good that is most intensive in this factor of production. However, specialization is often more complicated than this. Some countries' factor endowments are best suited for producing a number of goods but the country only specializes in one of these goods. This is where the concept of comparative advantage and opportunity cost dictate in what good a nation will specialize. These concepts are explained below.

Consider a two-good/two-country world and the table below:

	Production per Industry Employee	
	Clothing	Food
Nation A	6 units	3 units
Nation B	4 units	1 unit

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In the absence of trade, both countries must produce clothing and food for domestic consumption. It is clear that Nation A can produce more of both goods more efficiently than Nation B and therefore has the absolute advantage in both goods. In this example the assumption is that Nation A's production advantage occurs because of relative endowments of factors of production. Nation A has the land, labour and capital needed for both clothing and food production at a higher level than that of Nation B.

However, due to limited resources (land, labour and capital) that are inevitable in even the most abundant of countries, Nation A can produce only a limited amount of both goods no matter how efficient it is. If demand for clothing increases, Nation A would have to take resources from food production in order to increase clothing output. Nation B experiences the same situation where in order to produce more clothing, some food production capacity must be forgone. This is the basis for the idea of opportunity cost.

The opportunity cost of a product (clothing) is the alternative that must be given up (food) to produce that product (clothing).

(Blomqvist, Wonnacott, Wonnacott, 1994)

In the situation outlined above, if output of food in both countries were to increase Nation A would have to give up 6 units of clothing to produce 3 more units of food. That is, the opportunity cost of each additional unit of food is 2 units of clothing ($6/3$). Nation B would have to give up 4 units of clothing to produce one more unit of food. The opportunity cost of each additional unit of food is 4 units of clothing.

For the production of a certain product, the relative amount of opportunity cost between nations is the basis for the theory of comparative advantage.

If two countries (or regions or individuals) have different opportunity costs of producing a good or service, the country (or region or individual) with the lower opportunity cost has the comparative advantage in that good or service.

(Blomqvist, Wonnacott, Wonnacott, 1994)

There is more to consider than just absolute advantage in terms of understanding principles that impact on business development in any given industry. Comparative advantage influences specialization and trade decisions. Opportunity costs differ due to various combinations of land, labour and capital. In the example above, because Nation A has a comparative advantage in food, it would specialize in this product. Conversely, Nation B has a comparative advantage in clothing, and would specialize in this product. World output and consumption of both goods increases for both Nations A and B. Both nations gain by specializing in the area where they possess a comparative advantage and trading with each other.



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3.1 APPLICATION TO AGRICULTURE

Absolute advantage: Consider the example of Canadian wheat and barley production in Saskatchewan and Quebec. Saskatchewan wheat yields 50 bushels an acre, while Quebec yields 40 bushels an acre. In the case of barley production, Saskatchewan yields 40 bushels an acre while Quebec yields 10 bushels an acre.

	Wheat (bu/acre)	Barley (bu/acre)
Saskatchewan	50	40
Quebec	40	10

The example assumes that inputs applied to the crops are the same in both provinces. Saskatchewan is more efficient than Quebec at producing both wheat and barley and thus has an absolute advantage in both these commodities. However, should Saskatchewan produce both of these goods or specialize in one and trade with Quebec?

Comparative Advantage: Consider the opportunity cost of both provinces and the case of barley using the table above

One acre of land in Saskatchewan produces:

50 bushels of wheat
40 bushels of barley

One acres of land in Quebec produces:

40 bushels of wheat
10 bushels of barley

The opportunity cost of one bushel of barley in Saskatchewan is 1.25 bushels of wheat (50/40). The opportunity cost of one bushel of barley in Quebec is 4 bushels of wheat (40/10). Since the opportunity cost of barley is **LESS** in Saskatchewan than in Quebec, Saskatchewan has a comparative advantage in barley.

Similarly, in Saskatchewan switching one more acre of land into wheat production requires giving up 40 bushels of barley. In Quebec, switching one more acre of land into wheat production requires only 10 bushels of barley. The opportunity cost of growing wheat in Quebec is **LESS** than Saskatchewan and therefore Quebec has a comparative advantage in growing wheat.

In summary, due to differing levels of land, labour and capital, some nations or regions are more efficient at producing certain goods. The countries that have to give up the least to switch these resources into production of a certain other good have the lowest opportunity cost. The differences in opportunity costs occur due to differing levels and combinations of factor endowments. A country or region will specialize in production of the good that has the lowest



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opportunity cost given a 'free market' environment where no policy restrictions exist; such as supply management policies.

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4.0 LITERATURE REVIEW

In Steven Suranovic's book, International Trade Theory and Policy Suranovic states that comparative advantage is "perhaps the most important concept in international trade theory."

The initial conclusion that economists drew regarding specialization and trade was that absolute advantage drove nations to specialize in a particular good. Douglas Ruby (2003) defines absolute advantage in production as the ability of a nation to produce the same amount of output with less input relative to other nations. This idea can be extended to provinces and nations. Any discussion as to why nations (provinces) exhibit an absolute advantage in production generally revolves around the concept of factor endowments or factors of production. Factors of production are the resources that are the basic inputs used in the production of good and services.

Suranovic describes the idea of absolute advantage as intuitive while the concept of comparative advantage is rather counter-intuitive. Because of these characteristics, the two theories are often confused. However, with careful deliberation and explanation, a clear distinction can be drawn between the two theories.

As Ruby stated, absolute advantage draws nations to specialize in the good for which they possess an absolute advantage in production. Intuitive reasoning may lead the observer to the conclusion that such a country would produce all goods in which it has an absolute advantage to supply domestic needs. In reality, trade still takes place between countries that have an absolute advantage in many goods, and countries that do not have an absolute advantage in ANY good. (Ruby, 2003)

Specialization and trade takes place because of comparative advantage. A country possesses comparative advantage in production if it can produce a good(s) at a lower opportunity cost relative to another country. The opportunity cost of a product is the cost of the next best production alternative that must be given up to produce that product. There are a number of theorems related to comparative advantage of production, but the most widely studied is the Heckscher-Ohlin (H-O) Theorem.

Heckscher-Ohlin Theorem

The Heckscher-Ohlin theorem (H-O) is a classical economic theory known as a factor proportion theory. It deals with the three main categories of factor endowments: labour, land, and capital, and attempts to explain production advantages according to abundances in one or more of the three factors. The H-O is often explained in an environment of two goods and two nations. The goods produced assume different factor intensities for production while production technologies are assumed the same for both goods and in both nations. This narrows the discussion to relate production advantage to abundance of factor endowments. The H-O theorem specifically states that the capital abundant nation will produce and export the capital intensive good.

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Correspondingly, the labour abundant nation will produce and export the goods requiring abundant labour. According to this theorem, a country's advantage in production is a function of factor endowments relative to trading partners.

Porter's Diamond

Michael E. Porter is a Harvard business professor who believes standard classical theories on comparative advantage are inadequate. Porter's Diamond theorizes that a nation does not enjoy competitive advantage through comparative advantage alone but through the competitiveness of its firms. Porter defined competitive advantage as "a strategy that takes offensive or defensive action to create a defensible position in an industry, in order to cope successfully with competitive forces and generate a superior return on investment." Porter's four determinants of competitive advantage are:

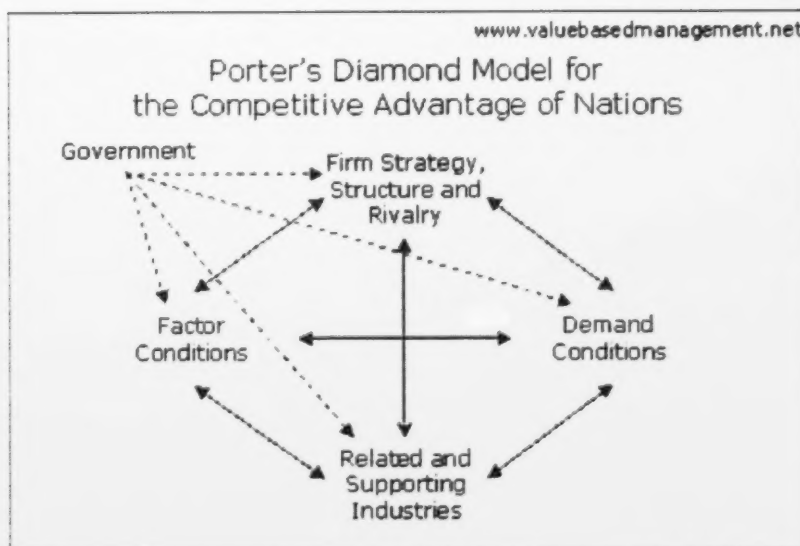
- 1) Factor conditions – These are the traditional factor endowments around which classical theories revolve. Porter introduced another level to these traditional factors by adding that specialization and refinement with these factors are also important to production. That is, not just land, labour, and capital but skilled labour, infrastructure and sustained capital investment. Porter even goes to the extent of saying that a scarcity of traditional factors is a specialized factor under his model. That is, a lack of resources fosters innovation and technological advancement.
- 2) Demand Conditions – According to Porter, a major advancement in international competitiveness comes from a sophisticated domestic market. Firms that face tough domestic markets are more likely to sell superior products because their market demands these products and close proximity to consumers of this type allows firms to better understand their needs and desires.
- 3) Related and Supporting Industries – Porter argues that a strong set of related and supporting industries is important to the competitiveness of a nation's firms. This leads to clustering or agglomeration of firms around their related industries. This clustering introduces a new set of competitive advantages such as technology sharing, association of the region with a certain product and applicable labour force.
- 4) Firm Strategy, Structure and Rivalry –
 - a. Strategy – Domestic capital markets affect the strategy of firms and their international competitiveness. Some countries have long-run capital outlooks, some have short-run and depending where a firm is located, these outlooks affect its strategy. A country will also have competitive advantage in an industry where employees feel their positions are prestigious and integral. Every nation has different industries where these feelings are fostered.
 - b. Structure – Again, each nation has a generally accepted management style, whether it is family owned business, or large hierarchical organizations. These differences in management style help a nation to become internationally competitive in certain industries.
 - c. Rivalry – It is a commonly accepted principle that stiff competition spurs innovation. If the domestic market is crowded with firms competing against each



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other, the nation's industry will innovate and evolve to a place of international competition.

The four determinants in Porter's Diamond are a system that is self-reinforcing where strength in each point affects the others. Government also plays an important role in Porter's Diamond model because government can influence all four of the determinants of competitive advantage. Government can create competitive advantage through subsidies, policies, and promotion of factor specialization. It can also limit competitive advantage through taxes, policies, and unrealistic standards.



(Value Based Management.net, 2005)

Porter's Diamond Model sheds light on the fact that in the modern business world, comparative advantage may not always arise from the sheer existence or abundance of traditional factor endowments. Globally, agriculture occurs within a complex web of regional factor endowments, geography, weather and policy. Agriculture is one of the most widely subsidized areas in the EU and these policies affect the comparative advantage that naturally occurs in member countries. In recent years, Spain has emerged as a leading hog producer while countries, like Germany, that have held this title in the past exhibit declining swine populations. (USDA, 2002) The growth in Spain's swine sector and the decline in Germany's can be attributed to the ever tightening environmental and health controls of the EU. Swine production has migrated to Northern Spain in the Catalonia region due to a number of factor endowments that were not as important under past policy regimes. Northern Spain is sparsely populated and isolated which helps to address EU disease outbreaks, animal welfare concerns and environmental regulations. Operations can house pigs less intensively and removed from populations concerned about health issues. (Lence, 2005) On top of land factor endowments, Northern Spain's swine producers enjoy low cost in another important factor of production, labour. (USDA, 2002)



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4.1 APPLICATION OF COMPARATIVE ADVANTAGE

As with any theory, understanding the implications of practical application is important. Studies have been conducted in this area using a variety of methods to apply comparative advantage to real world production and trading patterns. Some of these methods are examined below.

Policy Analysis Matrix

A study on food self-sufficiency in China, conducted by Fang and Beghin utilized a Policy Analysis Matrix (PAM) to test for comparative advantage in production. In 1995, China introduced policies to boost domestic grain output and self-sufficiency. The goal of Feng and Beghin's study was to analyze the correlation between government protectionism of grain production and its lack of comparative advantage.

The PAM is based on two major influences; profit and the effects of distorting government policies. Profit is a measure of both private profit and social profit or social efficiency. Comparative advantage is measured within the PAM through indicators of domestic resource cost, and social benefits and costs.

Fang and Beghin found that there was a positive correlation between grain production and lack of comparative advantage. With the elimination of government subsidies, the production of protected grain crops would drop drastically. The reasons for this relate back to China's factor endowments. China is limited in cropland, but abundant in labour. China's comparative advantage lies in production of rice and vegetables, which are labour intensive, and not in grain production, which is land intensive.

Heckscher-Ohlin Theorem Applied

A 1999 study by Dermot Hayes and Frank Fuller also focused on the grain production policy of China. Their study focused on what the production and trade patterns of China would be according to the theory of comparative advantage if Chinese agriculture were liberalized. Hayes and Fuller focused their study on the relationship between abundance of land, labour and capital and comparative advantages in production. Because Chinese agriculture does not exist in a free market system, US input/output coefficients were applied because the US agriculture economy exists where comparative advantage is allowed to influence production decisions.

Factors of production were segregated into the three main categories of land, labour and capital. By solving a linear function that takes into account production, consumption, and trade given the assumptions, the model estimates comparative advantage. The studies conclusions were much the same as those of Feng and Benghin. If China's agriculture was liberalized, production would shift away from land intensive grain production to labour intensive fruits and vegetable production. This is again due to China's relative abundance of labour versus land. In regards to capital, the study also determined that under current levels of land, labour and



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capital, capital would be fully utilized while some land and labour would be left idle. This is because there would simply not be enough capital available to mobilize the remaining land and labour. If capital is allowed to flow into China, under the Haynes/Fuller model, production of livestock and cash crops other than fruits and vegetables becomes possible because of the full utilization of all factors of production. According to this model, China even becomes a net exporter of some agricultural production.

Under a regime of trade liberalization, China would move to produce the agricultural goods that are intensive in China's most abundant factor endowments.

Revealed Comparative Advantage

Revealed comparative advantage was first introduced by Bela Balassa in "Trade Liberalisation and Revealed Comparative Advantage." Balassa claimed that a country's comparative advantage could be revealed through its import/export patterns. A country exports more of the good in which they specialize due to comparative advantage. (Balassa, 1965)

In 2005, Addison-Smyth applied revealed comparative advantage to Ireland's trade patterns. Addison-Smyth broke out export goods into United Nations' Standard International Trade Classification (SITC) that groups goods into large categories such as "food and live animals" and "beverages and tobacco." He then applied the Balassa Index, which examines the proportion of a good produced and exported relative to other countries. The equation results revealed Ireland's comparative advantage is in fuels, animal and vegetable oils, and manufactured goods. Addison-Smyth's conclusions can be related back to the H-O model because Ireland's revealed comparative advantage is in the industries that are intensive in its most abundant factor endowments.

Addison-Smyth also examined Balassa's theory that comparative advantage can be revealed through proportion of those factor endowments employed in certain industries relative to other countries. The same conclusions were reached through this application in that the sectors identified above were the largest employers.

This method suggests that analyzing trade flows can be a method to measure comparative advantage. However, it is based on current trade patterns as a measure of current comparative advantage. Using PAM and the H-O Theorem one can discuss likely comparative advantage even if two economies are not operating under a liberalized trade flow. This is important for discussing the comparative advantage of a given province in the production of a given commodity in Canada because many of the supply managed commodities do not operate under a liberalized system.

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5.0 COMPARATIVE ADVANTAGE APPLIED TO SUPPLY MANAGEMENT

A core principle of comparative advantage is that economies are trading in a free market system where free market is defined as an economy in which the actions of individuals and firms are dictated by the marketplace rather than by the government. Due to the regulatory component of supply-managed commodities, comparative advantage is not easily identified, or easily applied, in the supply-managed industry. Since the inception of supply management, commodities in the industry have not been "allowed" to freely locate in areas where comparative advantage exists. Location has been regulated by quota allocation based on historical production numbers rather than economic principles that apply to free market systems.

Section 23 (2) of The Farm Products Agencies Act states:

"In allocating additional quotas for anticipated growth of market demand, an agency shall consider the principle of comparative advantage of production."

In addition, Section 4(1) of Schedule B to the Farm Products Act identifies the following five criteria for consideration in the allocation of supply-managed quota:

- a) The principle of comparative advantage of production
- b) Any variation in the size of the market
- c) Any failure by producers in any province or provinces to market the quota authorized to be marketed.
- d) The feasibility of increased production in each province
- e) Comparative transportation costs to market areas from alternative sources of production.

This section looks at how comparative advantage could be applied under current supply management legislation and quota allocation methods.

Criterion 1: *The principle of comparative advantage of production* – In quota allocation, consideration should be given to comparative advantage and not solely to traditional allocation methods of historical production and population densities. Quota allocated by comparative advantage ensures the maximum output from minimum resources thus utilizing provincial resources as efficiently as possible. Allocating quota according to this principle provides maximum benefit for the Canadian consumer in terms of ensured quantity and lowest price because of optimum efficiency in production.

Criterion 2: *Variation in the size of the market* – Every year the Canadian population grows and therefore, by pure increase in size of the market, new quota must be allocated. Markets may also vary due to changing consumer demands and preferences. Allocation of additional quota and, potentially in certain circumstances, the reallocation of existing quota, will then

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correlate to market variation. Market variation is directly aligned with changing consumer trends. Given that one of the core principles of comparative advantage is consumer benefit, allocation of supply-managed quota as it relates to variation in the size of the market is highly correlated to the principle of comparative advantage.

Criterion 3: *The failure of any province to produce* – Allocation of additional quota, or potentially reallocation of existing quota, mandates the consideration of any given province's potential failure to produce. For example, disease and related bio-security is an issue that pertains to this criterion. If a province has an outbreak of a production limiting disease, then despite comparative advantage, that province may simply not be able to produce and allocation on this basis cannot occur. In the same way that Porter suggested government policy as another level of factor endowment, bio-security measures could also be considered an important factor endowment. Bio-security is an element of food safety issues that are becoming increasingly important to consumers. As consumers demand to know more about the food they are eating and where it can come from, areas that provide greater bio-security and food safety may exhibit comparative advantage. The areas that must give up less to provide bio-secure supply managed production will possess a comparative advantage.

Criterion 4: *Feasibility of production* – A prime example of this criterion is Prince Edward Island. Even though PEI enjoys significant comparative advantage in potato production, there is a limited land base in the province. Potato production can only occur at levels that are feasible for this small province. Similarly, if a province enjoys comparative advantage in a supply managed sector, the fourth criterion dictates that quota must be allocated in amounts that are manageable for each provincial economy. The resources that dictate comparative advantage are limited within each provincial border.

Criterion 5: *Comparative transportation costs* – This criterion introduces an important aspect of trade between two provinces. Transportation and trade will only occur if the transportation cost between two regions is less than the cost for each region to produce enough for domestic consumption. This concept also applies in situations where production and market are in separate regions. The cost to produce outside the market region and transport product in to the region must be less than producing in close proximity to the market region. That is, comparative advantage of production must outweigh the restrictions of transportation costs.

In summary, although comparative advantage is most often referred to in open markets, it can also be applied to production and markets that are controlled by government policy; specifically supply management.



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6.0 THE APPLICATION OF PROXY

Introduction

The purpose in examining hogs as a proxy for supply-managed poultry (called the feather industry below) is to provide an indication of support for the theory that firms will locate in areas where they enjoy comparative advantage of production. The assumption is that the supply management system constrains firms from behaving in this manner because the allocation of production quota ultimately dictates where firms will locate, rather than allowing the economic principle of comparative advantage to influence development. One of the tenets of comparative advantage is that regions enjoying high levels of particular inputs will produce goods that utilize those inputs. One method by which this effect can be measured is to study an industry that has evolved in a free market and free trade system that uses similar inputs to an industry that has been constrained in its production. The hog sector will be used as a proxy for the feather industries in the example below because hog production is not directly influenced by supply management.

6.1 THE HOG INDUSTRY AS A PROXY TO 'FEATHERS'

In this example, hogs are the free market commodity and the feather industry is the supply management commodity. Hogs are a good proxy to the feather industry for the following reasons:

- 1) Hogs and chickens are both produced through an intensive livestock operation (ILO) environment requiring significant capital investment where large numbers of animals are housed on single sites.
- 2) Due to the nature of ILOs, large amounts of infrastructure both on and off-farm is needed to keep the industry-based system operating smoothly and efficiently. A large amount of product leaves the farm regularly and a well-developed and structured transportation system is essential. Not only transportation, but also all off-farm support systems such as marketing boards, industry administration and centralized input suppliers are crucial to the operation of ILOs.
- 3) The primary feed ingredient for both hogs and chickens is feed grains such as barley and feed wheat. This commonality suggests that feed suppliers would be structured and operated similarly in both industries.
- 4) Feed represents the highest cost and most influential input into poultry and hog production. As a result, feed and production specialists have evolved into a consultant role for ILO managers. There is an exclusive niche for these types of consultants and technicians in the poultry and hog industry.

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- 5) Access to veterinary and other livestock medical services are an important part of the success of ILOs in both sectors.
- 6) Animal environment and housing are similar in both cases. Animals are raised in large indoor environments that are climate controlled.
- 7) Labour, financial and management structure is similar in both industries. A typical hog barn has an owner/manager, production manager and labourers who are in charge of feeding, breeding and monitoring the animals directly. Similarly, in a chicken barn, there is generally an owner/financial manager, production manager and labourers that breed, feed, collect eggs, and monitor animal health on a day-to-day basis.
- 8) ILO's in general have greater bio-security concerns than other non-intensive livestock operations. Hogs and poultry operations must take the same precautions against disease breakout and related issues that would affect the whole herd.
- 9) Both industries rely on an extensive genetic development system. This is necessary because ILOs are prone to inbreeding. The genetic development systems also play a role in bio-security programs within ILO's.
- 10) A large concentration of animals yields a large concentration of manure. Manure management and other environmental concerns similarly pertain to both industries and are regulated by government(s).

Hog Production Growth by Province

Data in the following sections is compiled from a select group of provinces. Because the objective of this report includes highlighting comparative advantage of production in Saskatchewan, all Prairie Provinces were selected for the data sample due to similar orientation characteristics. Quebec and Ontario were also selected because these two provinces have historically received a large portion of quota allocations. For these reasons, only five provinces were selected and are presented in the following discussions related to the evolution of the hog industry.

In order to understand what hog production data reveals about industry trends, it is important to first understand the difference between the percentage growth and actual growth. Percentage growth is the relative increase in the data from the base year, 1978, to 2004. Actual growth is the physical increase in the number of units that are being analyzed.

Example: Consider wheat production surrounding Saskatoon and Regina. On average, an acre of land near Saskatoon yielded 40 bushels in 1978. In 2004, the same acre of land yielded 45 bushels. On average, near Regina, in 1978 an acre of land yielded 38 bushels and in 2004, the same acre of land yielded 43 bushels. From this example, it appears that production increased by the same 5 bushels in both areas. In actual terms, this is true.

However, it is important to take into consideration how much yield increased in relation to yields during the first year of the period. To do this, 2004 production must be compared to 1978 production in 1978 terms. This is the relative value of the increase in production. Saskatoon



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production actually increased 112.5% (45/40) and Regina production increased 113.2% (43/38). Despite the same actual yield increase of 5 bushels, as a percentage of 1978 production, the yield increase was larger near Saskatoon. The actual increase in production does not explain fully how much production has really increased when compared to the beginning period.

Explanation of Data

For the subsequent sections the following data will be analyzed:

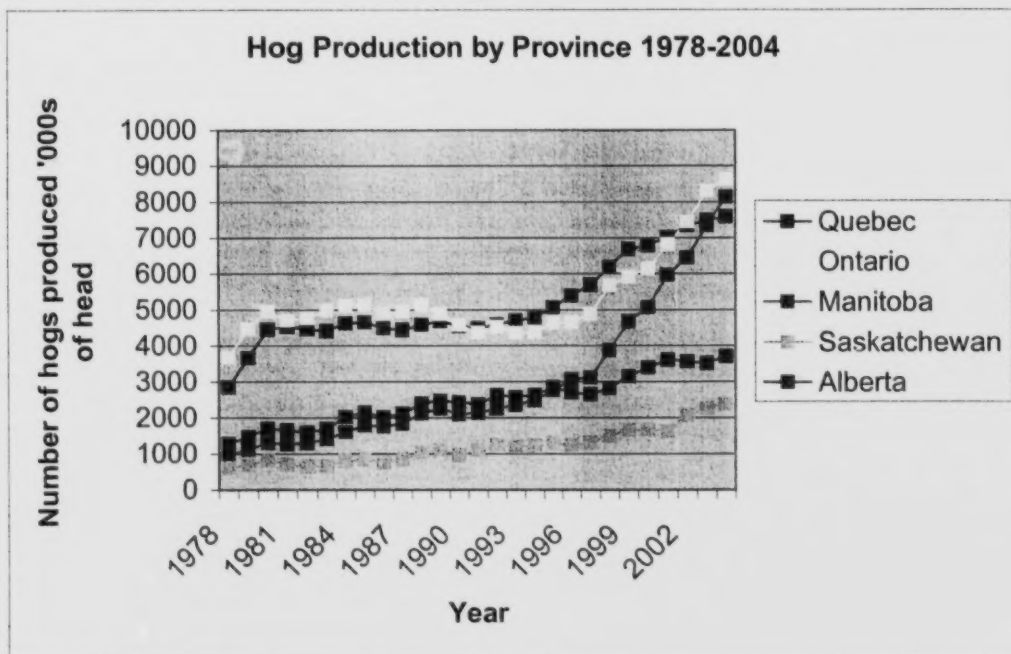
Hog Production: Annual number of hogs produced by province. Production is measured as number of slaughters, plus exports minus imports.

On-Farm Hog Inventory: Based on a physical count of the number of hogs on-farm at the end of the first quarter of each year.

Chicken Production: Measured in thousands of kilograms of meat production annually in each province.

Egg Production: Measured as annual provincial production minus disappearance.

Chart 1 - Hogs total production by province from 1978-2004



Statistics Canada

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The above chart illustrates the actual increase in number of hogs produced by province. During the period, all provinces grew in terms of number of hogs produced.

Table 1 - Number of Hogs Produced in Canada by Province

Province	# of Hogs (000's of head)		Percentage Growth	Actual Growth
	1978	2004	2004 as a % of 1978	(1978-2004)
Quebec	2846.8	7587.6	267%	4740.8
Ontario	3676.8	8633	235%	4956.2
Manitoba	948.2	8138.2	858%	7190
Saskatchewan	624.6	2382.9	382%	1758.3
Alberta	1276.2	3701	290%	2424.8
Total	9372.6	30442.7		21070.1

Statistics Canada, Canadian Pork Council

Percentage growth in number of hogs produced is measured in terms of the base year 1978. Actual growth is the difference in number of hogs produced between 1978 and 2004.

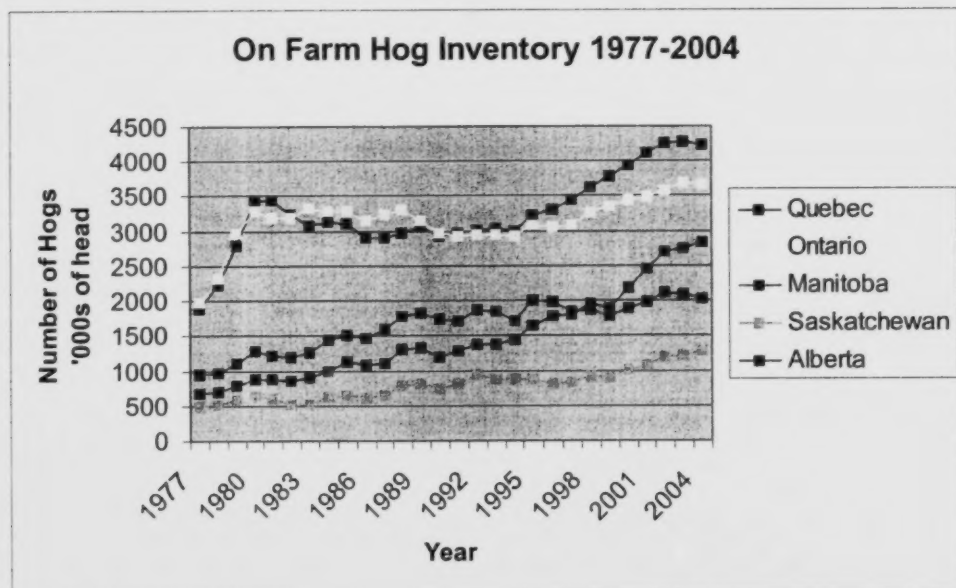
Similar to Chart 1 above, Table 1 shows that in each province, the actual volume of hogs produced increased from 1978 - 2004. However, Manitoba and Saskatchewan show the most substantial percentage increase with growth of 858% and 382% respectively. That is, Manitoba and Saskatchewan had the most growth in the number of hogs produced relative to 1978 production levels.

Expansion of Number of Hogs On-Farm by Province

Another method of analyzing how hog production has increased in Canada is by studying on-farm inventory of hogs from 1978 to 2004.

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Chart 2 - Number of hogs on farm by province for the period 1978-2004.



Statistics Canada, Canadian Pork Council

Similar to the growth pattern of number of hogs produced by province, the number of hogs on-farm has also increased during the period. The provinces depicted in Chart 2 all display considerable actual growth, however, an application of percentage growth reveals a more complete story.

Table 3 - Number of hogs on farm by province.

Province	# of Hogs ('000's of head)		Percentage Growth	Actual Growth
	1978	2004	2004 as a % of 1978	(1978 - 2004)
Quebec	2218	4220	190%	2002
Ontario	2325	3660	157%	1335
Manitoba	706	2840	402%	2134
Saskatchewan	525	1275	243%	750
Alberta	970	2030	209%	1060
Total	6744	14025		7281

Statistics Canada, Canadian Pork Council

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Percentage growth in on-farm hog inventory is measured in terms of the base year 1978. Actual growth is the difference between 2004 and 1978 inventory of hogs.

The data in Table 3 yields the same observations as the previous example. Inventory of hogs has increased in all provinces but in terms of percentage growth, Manitoba and Saskatchewan again show the largest increase.

Observations and Conclusions:

From the two data examples above, it is evident that:

- 1) Hog production has grown in all five provinces under consideration
- 2) Quebec and Ontario demonstrated the largest actual increase in both number of hogs produced and on farm hog inventory.
- 3) Manitoba and Saskatchewan show the largest percentage growth in number of hogs marketed and on-farm inventory of hogs.

These results lead to the following conclusions:

- 1) Hog production in Quebec and Ontario has steadily increased over the period 1978-2004.
- 2) In relation to base period production, hog production in Manitoba and Saskatchewan has increased at a much faster rate than in Quebec and Ontario.
- 3) For the private agricultural entrepreneur, there is something more attractive about locating hog production facilities in Manitoba and Saskatchewan compared to Ontario and Quebec.

There are many speculations as to why hog production has accelerated in the prairies; a number of which can be applied to the theory of comparative advantage.

1) Population Density

- a. Land use in Southern Ontario and Quebec is pressured by rapid population growth and urban sprawl. Agricultural users are being bought out and forced out of prime agricultural areas because these areas are also well suited to urban expansion. Manitoba and Saskatchewan are proportionally more agriculturally focused and therefore urban pressures are less in these provinces. Because there is less urban pressure, the opportunity cost of using prairie land for agricultural purposes is lower than in other provinces where urbanization and agriculture compete for the same land. The opportunity cost of using this land for hog production is the grain, cattle or other agricultural production that must be forgone rather than high priced urban development.



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2) Abundance of agricultural land

- a. Similar to the point above, the intensity of industry in Ontario compared to Saskatchewan. The competition for land suitable for industrial development is significantly more of an issue in Ontario simply because more industrial activity exists in Ontario. In fact, the argument can be made that industrial pressure is more of an issue in terms of competition for agricultural land than is urban pressure because urban communities do not want industrial development in their 'back yards'.
- b. Comparatively, Manitoba and Saskatchewan land prices are significantly lower than in Ontario. The urban and industrial demand is a major factor in terms of land prices. The relatively lower land prices provide a cost advantage when companies determine where to establish ILO's. Lower capital costs have additional benefits to ILO development as the businesses having lower breakeven costs of production and the associated better returns on investment. Yet another advantage in terms of lower capital costs is in obtaining financing and repayment obligations.

3) Bio-security concerns

- a. The application of comparative advantage to bio-security implications relates to the factor endowment of land, specifically the abundance of land. Because there is so much space for intensive livestock operations to choose from, they can locate at distances that are far apart. Spatial separation reduces bio-security concerns, and the opportunity costs are again only the agricultural production that must be forgone. However, it is more difficult to attain spatial separation in Ontario or Quebec because of the proximity of urban and industrial development and the sensitivity to ILO development nearby.

4) Environment

- a. There is increasing sensitivity to primary agricultural activity and its impact on the environment. This dynamic applies to all primary agriculture, regardless of scale. But it is significantly more of an issue in ILO development. One of the most sensitive environmental issues is the impact of manure distribution. Appendix A reveals that in comparison with other provinces there is significantly less manure production (measured in kg/hectare) in Saskatchewan. A similar situation exists in phosphate and nitrogen production associated with manure distribution. If Saskatchewan were to increase intensive livestock production, manure loading is not an issue in this province like in areas of Quebec or Southern Ontario. Increased production in these areas may require additional handling or special treatment of manure. Also, land is less available in these areas and competes for a wide range of uses as described above. Saskatchewan's opportunity cost of increasing manure loading is less than in the areas of Quebec and Ontario that appear to be reaching manure loading capacity.

5) Intensive livestock production inputs



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- a. Manitoba and Saskatchewan grain producers, in part due to the elimination of the Grain Transportation Subsidy (the 'Crow Rate'), cannot profitably export feed grains such as feed barley and feed wheat. However, farmers, in a significant area of the two provinces, must commit certain acreage to feed grain production due to rotational and climatic considerations. Given the economics of grain production, farmers in the two provinces have proactively proceeded to increase the utilization of feed grains by increasing animal production, such as hogs, and thereby using the feed grain. The largest volume and most expensive input into intensive livestock operations is feed grains. Comparative advantage of feed grain production exists in the Prairie Provinces. This comparative advantage spills over into livestock production due to cheaper inputs and lower opportunity cost of producing this major input in the same region as livestock production.

6) Labour

- a. Agriculture represents a higher percentage of labour utilization in Saskatchewan than in Ontario. However, the demand for labour relating to industrial development is less of an issue in Saskatchewan, especially as distances from major urban areas increases. The latter is an important consideration given the vastness of rural land area in Saskatchewan compared to Ontario. Those wishing to find employment within a new intensive livestock operation in Saskatchewan have a lower opportunity cost in terms of other employment in the area compared to Ontario or other provinces where there are numerous employment opportunities in the industrial sector.



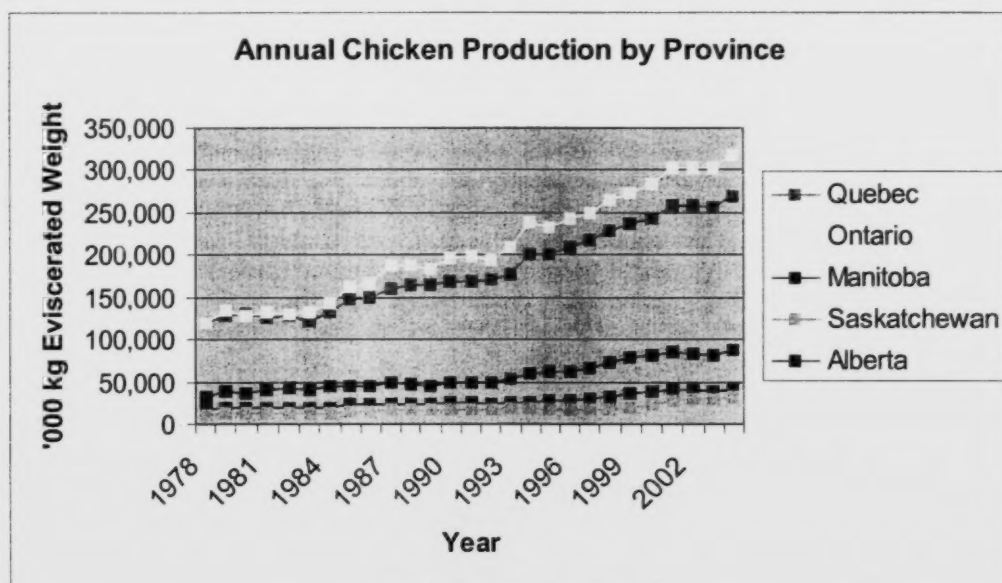
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6.2 SUPPLY MANAGED COMMODITY: THE FEATHER INDUSTRY

Chicken Production

In the preceding sections, the growth and movement patterns of the hog industry were reviewed and reasons presented as to why these patterns arose. In the beginning of the section, hogs were identified as being an applicable proxy to feather production. However, the feather industry falls within the influence of the confines of the supply management system, so growth and movement patterns display a much different picture than hogs.

Chart 3 - Annual chicken production by province for the years 1978-2004



Statistics Canada

The data presented above shows a wide separation in quota allocation between Ontario/Quebec and the prairies. However, each year new quota is allocated and distributed so that each province shows an increase in chicken production. Ontario and Quebec again show the greatest actual increase over the period. Examining the data in percentage growth terms provides a more intuitive look.

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Table 4 - Annual chicken production in '000s of kgs for the years 1978 and 2004.

	Thousands of Kgs		Percentage Growth	Actual Growth
Province	1978	2004	2004 as a % of 1978	(1978-2004)
Quebec	118,582	268,563	226%	149,981
Ontario	118,661	318,701	269%	20,040
Manitoba	17,005	40,499	238%	23,494
Saskatchewan	10,852	32,937	304%	22,085
Alberta	32,331	88,093	272%	55,762
Total	297,431	748,793		451,362

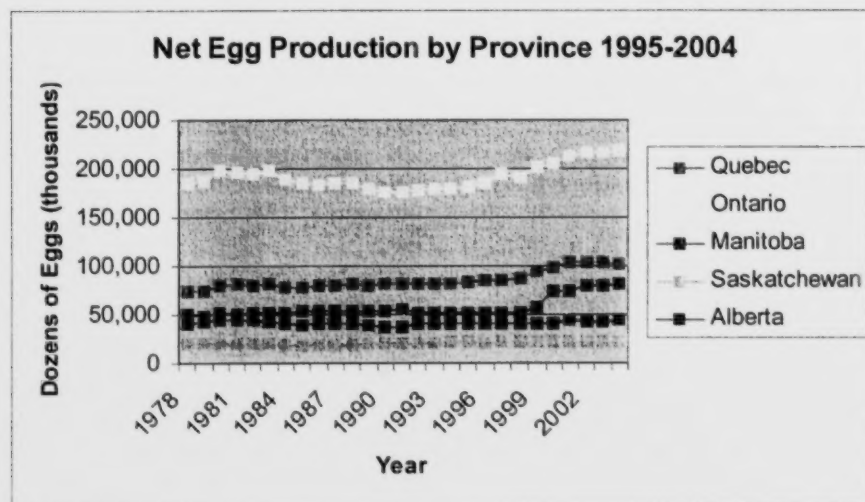
Statistics Canada

Percentage growth is growth in terms of the base year, 1978. The difference column calculates growth in actual terms by subtracting 1978 from 2004 production levels.

In the case of chickens, Saskatchewan actually enjoyed the largest percentage increase in production and quota. This period increase can be attributed to a special quota allocation consideration that Saskatchewan received in the 1990's.

Egg Production

Chart 4 - Net annual egg production by province for the years 1978-2004



Statistics Canada

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Egg production in this sample shows a wide separation between Ontario and the rest of the provinces. Allocation has been made to all provinces during the period, however, Ontario displays the largest actual increase in quota allocation while Saskatchewan displays the lowest.

Table 5 - Annual egg production in thousands of dozens for the years 1978 and 2004.

Province	Thousands of dozens		Percentage Growth	Actual Growth
	1978	2004	2004 as a % of 1978	(1978-2004)
Quebec	73,800	101,483	138%	27,683
Ontario	184,756	218,589	118%	33,833
Manitoba	49,377	81,758	166%	32,381
Saskatchewan	20,220	22,498	111%	2,278
Alberta	41,047	43,883	107%	2,836
Total	369200	468211		99011

Percentage growth measures period growth in terms of the base year, 1978. The actual growth column calculates production increase by subtracting 1978 from 2004 production levels.

Table 5 displays the range of actual production in the provinces over the time period from Alberta's 107 % to Manitoba's 166%. Saskatchewan exhibits the second lowest percentage growth at 111%.

Conclusions

Comparing the hog industry to the feather industry reveals that in an industry unaffected by supply-management policy more development and growth has occurred in Saskatchewan than in Ontario and Quebec. The natural unimpeded growth of the hog industry in these provinces can be attributed to comparative advantage by using Addison-Smyth's theory of revealed comparative advantage. Addison-Smyth suggests that by comparing the proportion of goods exported (produced) in one area (province) to another, comparative advantage is revealed. Application of the theory and testing the statistics of production provides an indication of the comparative advantage that Saskatchewan enjoys in hog production. By extension of the proxy Saskatchewan would also enjoy comparative advantage of production in poultry if production limitations associated with supply management policy did not exist.

An interesting conclusion can be drawn from the chicken and egg industry. Saskatchewan was awarded a special consideration of additional chicken production quota and with that award, can be more favorably compared to Ontario and Quebec in terms of their relative share of quota and as it is compared to the hog industry. The same comparison cannot be drawn to egg production

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and hogs. Saskatchewan is disadvantaged in terms of the allocation of egg production quota as compared to Ontario and Quebec.

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7.0 THE APPLICATION OF A COMPANION INDUSTRY IN A NON-SUPPLY MANAGED JURISDICTION

The purpose of conducting a companion industry study is to observe the evolution of a Canadian supply managed commodity and the same commodity in a non-supply managed or free market environment. The egg industry in the United States was chosen for analysis and comparison to the egg industry in Canada. Eggs were chosen because out of all the Canadian supply managed commodities, Saskatchewan receives the most inequitable portion of quota allocation. The hypothesis in conducting the companion study is the same as that for the proxy study. That being that in a non-supply managed environment, the egg industry in Canada (supply managed market environment) would have developed in a similar fashion to that of the United States (free market environment).

7.1 REASONS FOR SELECTED PROVINCES/STATES

The United States is a meaningful and relevant comparison to Canada because both countries share similar production environments, markets, policy, trade patterns, border and labour skills.

The Canadian provinces chosen for the companion industry study are Saskatchewan and Ontario. Saskatchewan was selected because the purpose of the study is to evaluate comparative advantage of production and quota allocation inequities in this province. Ontario was chosen because the majority of quota is distributed to Ontario and Quebec under current quota allocations. Ontario's selection was based on a random selection between these two provinces.

Nebraska and Michigan were selected as comparable states because they have a number of similarities to Saskatchewan and Ontario respectively. The similarities that are of interest in this study are those with applicable contribution to comparative advantage of production and economic and environmental factors that affect production. These factors outlined below have been identified as some of the key factors in determining comparative advantage of production.

Geography/Climate

Saskatchewan and Nebraska are both centrally located in North America in the Central Plains area. The climate in both areas is similar. However, Nebraska is situated farther South so the agricultural season is longer. Ontario and Michigan are both located on the Great Lakes. This creates similar lake effects and climate in both regions. Southern Ontario and Northern Michigan share the same latitude providing for very similar climates in these areas. Topography of southern Ontario and Michigan is very similar. Northern Ontario land does not possess agricultural potential, as two-thirds of Ontario is Canadian Shield occupied by forests and lakes.

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Figure 1 - Map of North America showing geographical location of Saskatchewan, Southern Ontario, Nebraska and Michigan.

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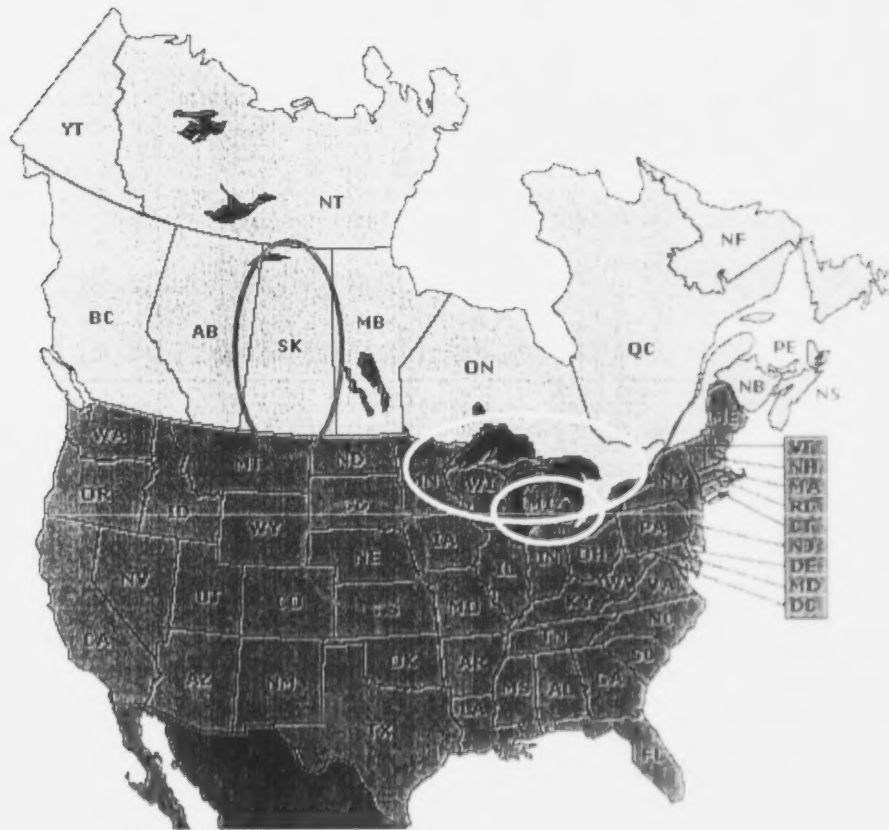


Figure 1 - Map of North America showing geographical location of Saskatchewan, Southern Ontario, Nebraska and Michigan.

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Transportation

A good measure of "distance to market" is distance to major urban centers. Distance to major urban centers is calculated in highway kilometres. This also provides an indication of transportation infrastructure.

Table 6 - Michigan and Nebraska: distance from major markets

	From Southwest, Michigan (kms)	From Lincoln, Nebraska (kms)
Chicago, IL	152	838.4
Detroit, MI	297.6	1307.2
Milwaukee, WI	313.6	899.2
Cincinnati, OH	398.4	1238.4
Madison, WI	398.4	776
Louisville, KY	420.8	1123.2
Cleveland, OH	422.4	1376
St. Louis, MO	587.2	710.4
Pittsburg, PA	604.8	1547.2
Des Moines, IA	660.8	300.8
Buffalo, NY	731.2	1691.2
Minneapolis, MN	816	694.4
Kansas City, MO	963.2	308.8
Tulsa, OK	1219.2	723.2
Denver, CO	1731.2	779.2

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Transportation Warehousing Distribution Logistics - State of Nebraska

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Table 7 - Ontario and Saskatchewan: distance from major markets.

	From Windsor Ontario (kms)	From Regina Saskatchewan (kms)
Vancouver, BC	3990	1820
Calgary, AB	3064	771
Thunder Bay, ON	1261	1273
Sault St. Marie ON	522	1977
Toronto, ON	381	2669
Montreal, QC	869	2981
Quebec City, QC	1126	3157

United Van Lines

Tables 6 and 7 provide relevant comparisons between Michigan and Ontario which are both closer to a larger number of major markets in their respective countries and Saskatchewan and Nebraska which are both farther away from the majority of large markets.

Demographics/Population

Table 8 - Urban/rural population by state and province.

	Michigan			
	Total Population	Rural Population	Urban Population	% Rural
1990	9,295,297	1,660,530	7,634,767	17.86%
2000	9,938,444	1,839,156	8,099,288	18.51%

United States Census Bureau

	Ontario			
	Total Population	Farm Population	Urban Population	% Rural
1991	10,084,885	226,680	9,858,205	2.25%
2001	11,410,046	186,085	11,223,961	1.63%

Statistics Canada

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	Nebraska			
	Total Population	Rural Population	Urban Population	% Rural
1990	1,578,385	751,172	827,213	47.59%
2000	1,711,263	768,760	942,503	44.92%

United States Census Bureau

	Saskatchewan			
	Total Population	Farm Population	Urban Population	% Rural
1991	988,928	159,290	829,638	16.11%
2001	978,933	123,385	855,548	12.60%

Statistics Canada

One distinction to note in Table 8 is that for Michigan and Nebraska, rural is defined as open country and settlements with fewer than 2,500 residents. The Canadian data presented is urban and farm where farm is the population of each province actually residing on a farm and participating in some level of farm activity. Table 8 clearly shows the rural population of Nebraska and Saskatchewan is much higher than Michigan and Ontario throughout the 10-year period. That is, both Nebraska and Saskatchewan share a more rural and by assumption more agricultural based population than Michigan and Ontario.

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Economy/Employment

Table 9 - Gross State Product is calculated as gross output minus intermediate inputs. All figures are stated in Canadian dollars at exchange rate of \$US/1.25 \$CDN.

Millions of \$ CDN				
	1998	1999	2000	2001
Michigan				
Total Gross State Product	\$387,505	\$ 410,388	\$422,470	\$423,373
Agriculture, forestry, fishing, and hunting	\$2,131	\$2,191	\$1,984	\$2,024
Agriculture as % of Total GSP	0.55%	0.53%	0.47%	0.48%
Nebraska				
Total Gross State Product	\$65,190	\$67,259	\$69,836	\$72,646
Agriculture, forestry, fishing, and hunting	\$3,626	\$2,563	\$2,449	\$3,128
Agriculture as % of Total GSP	5.56%	3.81%	3.51%	4.31%

Bureau of Economic Analysis, United States Department of Commerce

Table 10 - Gross Provincial Product is calculated as the gross economic production in each province. Ontario's GPP is measured in 1997 dollars while Saskatchewan's is measured in 1990 dollars. Primary industry is defined as total of agricultural production and natural resource extraction (mining, oil and gas extraction.)

Millions of \$ CDN				
	1998	1999	2000	2001
Ontario				
Total Gross Provincial Product	\$347,432	\$373,766	\$391,653	\$396,471
Primary Industries	\$7,196	\$7,762	\$7,632	\$7,244
Primary Industry as % of Total GSP	2.07%	2.08%	1.95%	1.83%
Saskatchewan				
Total Gross Provincial Product	\$27,409	\$28,747	\$31,941	\$31,396
Primary Industries	\$6,430	\$7,159	\$9,070	\$7,808
Primary Industry as % of Total GSP	23.46%	24.90%	28.40%	24.87%

Statistics Canada
Ontario Ministry of Finance



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Tables 9 and 10 show the relative importance of agriculture to the respective American and Canadian economies. Table 9 shows agriculture in proportion to gross state product. Using this comparison, agriculture and agriculture related activities are a larger part of the Nebraskan economy than the Michigan economy.

Data in Table 10 was not available for solely agriculture, only primary industries, which include agricultural production and natural resource extraction. Primary industry as a percentage of total GPP will always be larger in this situation than agriculture alone. Also, GPP was measured in different base dollars, 1990 and 1997, which also makes value-to-value comparison difficult. However, despite these data differences, relative proportions of primary industry to total GPP can still be effectively compared. Relatively, the primary industries comprise a significantly larger portion of total GPP in Saskatchewan than in Ontario.

The relevant comparison between the Canadian provinces and their companion states reveals that agriculture makes up a larger part of the Saskatchewan and Nebraskan economies than Ontario or Michigan. This suggests that Saskatchewan and Nebraska are similarly more agriculturally based than Ontario or Michigan. Addison-Smyth's theory of revealed comparative advantage can be applied to suggest that Saskatchewan and Nebraska's economies reveal a comparative advantage in agriculture. Addison-Smyth suggested that comparative advantage is revealed by a region's volume of exports, however, this idea can be related to production. Nebraska and Saskatchewan reveal their comparative advantage in agriculture through volume of production relative to the comparison states of Ontario and Michigan.

Labour

Table 11 - Percent of labour employed in agriculture and agriculture related industries.

	Ontario Employment ('000s)		
	Total Employment	Agricultural Employment	% Agriculture
1999	5688	114	2.0%
2000	5872	98	1.7%
2001	5963	84	1.4%

Statistics Canada

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	Saskatchewan Employment ('000s)		
	Total Employment	Agricultural Employment	% Agriculture
1999	471.6	65.8	14.0%
2000	473.6	61.5	13.0%
2001	460.6	50.5	11.0%

Statistics Canada, Labour Force Survey

	Michigan Employment ('000s)		
	Total Employment	Agricultural Employment	% Agriculture
1999	5,519	742	13.4%
2000	5,629	746	13.2%
2001	5,530	744	13.5%

Bureau of Economic Research Service, USDA

	Nebraskan Employment ('000s)		
	Total Employment	Agricultural Employment	% Agriculture
1999	1,166	241.8	20.7%
2000	1,183	242	20.5%
2001	1,184	242	20.4%

Bureau of Economic Research Service, USDA

In 2001, Ontario had almost 13 times more people employed than Saskatchewan. However, a larger portion of the Saskatchewan labour force was employed in agriculture. In the same year, Michigan had almost 5 times more people employed than Nebraska. However, a greater proportion of Nebraskan workers were employed in agriculture than in Michigan. These employment numbers demonstrate relative agricultural employment opportunities for the labour force in each province and state. These numbers also provide an indication of the amount of agricultural labour in each region. Saskatchewan and Nebraska both have more agricultural laborers than do Ontario and Quebec. However, the statistics in Table 6 do not provide information on the availability of this labour; that is, the employment rate of agricultural laborers.



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Egg Production

Table 12 - Egg production in Michigan and Nebraska for the period 1978-2004.

Year	Nebraska (millions of dozens)	Michigan (millions of dozens)
1978	65,000	124,750
1979	66,833	124,250
1980	70,583	121,583
1981	66,833	128,417
1982	67,417	127,083
1983	66,000	121,167
1984	64,417	126,583
1985	70,333	141,083
1986	69,083	137,000
1987	72,417	138,000
1988	75,167	129,417
1989	86,417	121,167
1990	100,167	117,167
1991	116,667	116,333
1992	148,083	116,500
1993	168,917	116,750
1994	168,917	119,583
1995	198,667	115,583
1996	194,667	109,833
1997	205,750	110,583
1998	225,500	116,250
1999	236,417	127,750
2000	249,917	135,083
2001	250,083	139,750
2002	248,083	147,583
2003	260,500	157,333
2004	264,500	167,417

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Table 12 displays egg production growth in Michigan and Nebraska. In 1978, Michigan produced almost twice as many eggs as Nebraska. However, thirteen years later in 2004, Nebraska produced over 97,000 million dozen more eggs than Michigan. In terms of relative production growth during the period 1978-2004, Michigan grew 134% while Nebraska grew 407%.

Table 13 - Egg production and value for Ontario and Saskatchewan for the period 1978-2004.

Year	Ontario (dozens of eggs)	Saskatchewan (dozens of eggs)
1978	184,756	20,220
1979	186,926	19,482
1980	197,893	19,821
1981	196,489	20,804
1982	195,361	19,915
1983	198,059	20,054
1984	188,438	18,907
1985	184,756	18,689
1986	182,610	18,798
1987	185,084	18,871
1988	185,335	19,159
1989	179,460	19,845
1990	176,451	19,870
1991	175,920	19,586
1992	177,208	20,557
1993	179,271	20,818
1994	179,832	21,630
1995	180,798	21,918
1996	186,070	21,280
1997	194,139	21,779
1998	191,429	21,950
1999	201,058	21,706
2000	205,494	21,626
2001	212,876	22,258
2002	216,585	22,927

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Year	Ontario (dozens of eggs)	Saskatchewan (dozens of eggs)
2003	216,957	22,976
2004	218,589	22,498

Table 13 displays egg production growth in Ontario and Saskatchewan. Ontario's production grew 118% while Saskatchewan production only grew 111%. This is a much different scenario than American egg production presented in Table 13. The difference can be attributed to the supply management system in Canada. During the time period, egg production in Ontario and Saskatchewan was restricted from free-market growth patterns.

Conclusion

In a direct comparison of the egg industry between Canada and the United States, growth patterns of the two industries are very different. Under the assumption that Canada and the United States share similar production environments, one can conclude that under a free market system, Canada's egg industry would have grown similarly to the American industry. Considering the similarities between Saskatchewan and Nebraska and Michigan and Ontario as presented above, one can conclude that egg production in the Canadian provinces would have followed the development patterns of their companion state under the same free market system. Accordingly, the growth patterns in the United States can be attributed to comparative advantage and the factors endowments utilized in egg production as explained in previous sections. The theory behind this analysis of a companion industry is further examined mathematically in the next section.

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8.0 ECONOMETRIC ANALYSIS

Paul A. Ruud, author of An Introduction to Classical Econometric Theory and professor at Oxford University, states that mathematical projection is the principle behind econometrics. The purpose of this analysis is to use economic data from the U.S. to make predictions about egg production growth in Canada in the absence of supply management. Data pertaining to the United States' open market egg industry has been collected and applied to the Canadian supply restricted industry. Assuming that efficient supply managed industries should closely resemble the free market, Canadian results based on the US regression can be compared to current quota allocations to show whether Saskatchewan deserves more production.

The theory of comparative advantage can be used to explain the movement of goods between regions. This theory suggests that initial endowments of resources and specialization in production will allow one region to produce specific goods more efficiently than others. By allowing that region to focus their production on these efficiently produced goods the region can trade for other goods and gain in total consumption, as long as these goods are valuable to their trading partners. These initial endowments are also expected to play an important role when considering subsequent growth in production as initial comparative advantage will also support research and innovations that make use of that advantage.

It is very difficult to predict the real comparative advantage of a region in egg production if it has historically been limited by legislation as is the case in Canada's supply managed agricultural sectors. This analysis assumes that original allocations of labour, land and agricultural productivity are a good predictor of the future location of egg production when that production is not restricted by legislation.

8.1 METHODOLOGY

The following framework is based on an estimation of the growth in egg production from 1978 to 2004. Data from 48 states in the US were used to estimate the importance of various starting endowments on the rate of growth. The model predicts the growth in the level of egg production in a certain region using various relevant factors of production for that region from the beginning period. 1978 was chosen as the beginning period because this is the year that the supply management legislation was implemented in Canada.

This framework considers the application of comparative advantage theorem and specifically considers elements of factor endowments associated with this theorem. These factor endowments were previously identified in the literature review as items that have impact on a region's relative comparative advantage of production.

Using data from the United States, coefficients for the model's variables can be estimated. Data from Canadian provinces can then be substituted into the model to predict the growth in number of eggs produced from 1978 to 2004 in each province if that production had grown like the



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States of the U.S. Since the U.S. growth could have been caused by growth due to changes in demand and supply both supply and demand factors are included in the estimation. The estimated model is as follows:

Growth in number of eggs produced = $B_0 + B_1[\text{Agricultural Land}] + B_2[\text{Environment}] + B_3[\text{Labour}^1] + B_4[\text{Labour}^2] + B_5[\text{Feed Availability}] + B_6[\text{Transportation}] + B_7[\text{Population}] + B_8[\text{Egg Production}]$

This equation suggests that the growth in egg production can be estimated by weighting the impact of each of the variables listed.

Growth in number of eggs produced is the difference in quantity of eggs produced from 1978 to 2004.

Agricultural Land is the region's number of arable acres in 1978.

- An arable acre is land specifically designated as agricultural land. This is a measure of the availability of land for new/expanding operations, manure disposal and feed production.

The Environment variable is calculated by dividing 1978 arable acres by 1978 kilograms of manure produced.

- Environment is a measure of the land's capacity to support existing/increased livestock production. Manure production is a valuable indicator because it is directly related to the level of livestock production. This calculation also gives some indication of bio-security measures where bio-security is defined as density of animal populations. Manure production can be used as a proxy for animal population and thus the calculation is a measure of livestock density within a region.

Labour¹ is 1978 unemployment rate.

- Unemployment rate is an indicator of the availability of labour. Total regional unemployment is used because this number was calculated uniformly across the observation area and other measures of labour availability such as agricultural labour were either calculated differently in each region or unavailable for 1978.

Labour² is 1978 minimum wage.

- Minimum wage is an accurate measure of a region's standardized cost of labour. This indicator is readily available and calculated uniformly across regions.
- Assuming that a region's unemployment rate is very low, minimum wage is an indicator of the cost to draw labour away from other employers.

Feed Availability is the total state grain production in 1978.

- This is a standardized measure of the feed production capacity of each region that existed in 1978. Production capacity identifies availability of livestock feed and capability of a region's feed supply to support increased livestock production. Grain production (corn, wheat and barley) is a good measure because this is the most common livestock



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feed ingredient in the USA and Canadian livestock operations. Calculating each grain's relative chicken feed value standardized the production volumes. This value is often measured in calories and a summation of total calories available to layers from these grains in each region represents feed availability.

Transportation is measured as the distance in kilometers to the closest major urban center.

- Transportation is strictly a measure of distance to market. A representation of major regional markets was identified in order to standardize distance measures.

Population is measured as total number of people living in the state in 1978.

- Population is an indicator of labour as a factor of production. It also indicates the level of local demand for production.

Egg Production

- Egg production is 1978 egg production. This variable has been included because the amount of production that occurred in the beginning period may have an affect on the future growth of egg production.

Using Econometrics

- The model removes any bias as to which factor of production is more important in the determination of where production growth occurs because the weighting of the factors is based on fitting an equation to the actual data. The B's in the model above can be chosen using this actual so as to minimize the errors (squared errors to be specific) observed when the equation is applied to real data.
- The model predicts egg production growth based on actual data. The data may support a model or hypothesis but it cannot conclude that all important factors affecting egg production growth have been captured. The factors that have been included can ultimately be related back to comparative advantage or changes in demand but there may be other factors that would help to explain the growth in egg production from 1978 to 2004.
- Econometric forecasters must always take caution when applying a model to predict occurrences. Models are based on historic data and restricted to a certain set of circumstances. Future conditions and conditions outside this set of circumstances may change outcomes drastically in a way that an econometric model could never predict.

US Data Collection

To create the predictive model, state level data was compiled from the United States. Alaska and Hawaii were omitted because the geographical locations of these states dictate a very low level of livestock product production. Data was collected in the remaining 48 with the specifications noted below.

Egg Production Growth

Egg production growth is measured as the difference in number of eggs produced annually from 1978 to 2004.



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Agricultural Land

Total state arable acres where arable acres are described as land designated for agricultural purposes. Agricultural land data was collected in acres per state. The model assumes that arable acres have not changed from 1978 to 2004.

Environment

Manure production data was collected for the year 1978 in tons per state. This measurement was presented by weight only and does not take into consideration the differing concentrations of manure from various livestock. Imperial tons were converted to metric for model calculations. Tonnes of manure was divided by the number of arable acres per state to represent the manure application capacity of the state.

Labour¹

1978 unemployment rates were collected according to the traditional economic definition of the percentage of population that is looking for work but cannot find employment. This number provides information on the number of people looking for work relative to the number of jobs available. It does not provide information on the total number of people with/without jobs, as this number gives no indication of labour availability.

Labour²

1978 minimum wage in the United States is more complex than in Canada. Minimum wage is governed at both the federal and state level. As of 1978, the federal minimum wage was \$2.90/hr. In a state that had minimum wage requirements above this level, state requirements prevail. In a state that had minimum wage requirements below the federal level, whether state or federal requirement prevails depends on the size of the business. Due to these conditional laws the model assumes that if there was no state level minimum wage requirement, or the state requirement was below the federal level, the federal minimum wage of \$2.90/hr was used as a data point.

Feed Availability

1978 corn, wheat, and barley production data was collected in '000s of bushels for the year 2004. Multiplying each grain by its relative feed value for layers standardized the feed production data. That is, the feed value in corn, wheat and barley for a layer is 3000, 3150, and 2850 calories per kilogram respectively. Grain production in bushels can be converted to tonnes using the assumption of 39.368, 36.744, and 45.93 bushels per tonne of corn, wheat and barley respectively. Production tonnage is converted to calories and a summation of the total calories for each state's grain production was used as a standardized measure of feed availability.

Transportation

The major US markets identified were Los Angeles, CA, New York, NY, Chicago, IL, and Houston, TX. The distance in kilometers from each state's capital to the closest of each of these centers was used as distance to market. The state capital was used as a measurement point in order to standardize distances and because this information is readily available.

Population

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Population is the total number of people living in each state in 1978.

8.2 OBSERVATIONS

Microsoft Excel was used to calculate the predictive regression model. The program provided the output shown in Table 14.

A regression takes a large pool of information (independent variables) and tries to find the best fit or pattern for the data in accordance with the outcome being measured (dependant variable). Each factor of production impacts egg production growth in some way. Some factors seem to strongly affect egg production growth while others seem to have no significant impact on each state's difference in egg production from 1978 to 2004.

To infer information from a regression model, the following statistical tools must be understood.
T-stat: Gives information on the relevance of the coefficient. The farther from 0 the t-stat is, the more confidence there is that the variable has an impact on egg production.

P-value: Indicates the probability that the coefficient has no effect on egg production. The closer the p-value is to 0, the more confidence there is that the variable has an impact on egg production.

R-Square: Gives an indication of how well the regression fits the data set as a whole. An R-square of 1 means that the regression fits the data perfectly and the independent variables can be used to perfectly estimate the dependent variable. An R-square of 0 means that the regression does not fit the data at all and there is little evidence that the independent variables are having an effect on the dependent variable.

Coefficient sign: The sign of each coefficient indicates how that particular variable affects egg production. In our model, if B_1 has a positive sign, then as Agricultural Land increases, the growth in egg production would be expected to increase. If the sign were negative, then increasing Agricultural Land would lower the growth in egg production.

Table 14 - Regression based on 1978 state level data.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.6390
R Square	0.4083
Adjusted R Square	0.2869
Standard Error	1503697489.0597
Observations	48.0000



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	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-217635273.4748	1760670125.8755	-0.1236	0.9023
Agricultural Land	-0.4642	39.2850	-0.0118	0.9906
Environment	-120883899.1468	96110316.4020	-1.2578	0.2160
Population	-44.1224	84.9041	-0.5197	0.6062
Transportation	161712.1198	536600.5679	0.3014	0.7647
Unemployment	78321426.7937	249031199.5496	0.3145	0.7548
Minimum Wage	23460434.3324	409091229.2268	0.0573	0.9546
Grain Production	52.4858	12.9992	4.0376	0.0002
1978 Egg Production	-0.1021	0.1938	-0.5271	0.6011

The variable that appears to have a significant impact on egg production growth is grain production or feed availability. This variable has the highest t-stat indicating the model is most certain that feed availability has an impact on egg production compared to the other variables. Specifically, regions with higher beginning period feed availability exhibited greater growth in egg production from 1978 – 2004.

The adjusted R^2 of this regression is .29 indicating that the variables in the model account for only 30% of the variation in egg production growth.

However, there is a statistical error, multicollinearity that may be occurring within the model. An error of multicollinearity occurs when two independent variables correlate not only with the dependant variable, but also with each other. When the effect of two or more variables is the same on the dependant variable, multicollinearity occurs. To solve this error, all but one of the correlating independent variables can be removed so that the effect is calculated only once within the regression.

In this case, agricultural land and grain production are most likely correlating with each other. That is, the more agricultural land a state has, the more grain production will occur in that region. The hypothesis is that these two variables will have the same effect on the change in egg production during the period.

By removing one of these variables, the multicollinear effect is removed; as illustrated in Table 15.

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Table 15 - Regression based on 1978 state level data with agricultural land omitted.

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.64
R Square	0.41
Adjusted R Square	0.30
Standard Error	1484784959.82
Observations	48.00

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-227677681.9793	1522548523.2394	-0.1495	0.8819
Environment	-121220501.9069	90636745.5353	-1.3374	0.1886
Population	-44.4444	79.3999	-0.5598	0.5788
Transportation	160909.2215	525585.9460	0.3062	0.7611
Unemployment	79697398.8860	217356613.6494	0.3667	0.7158
Minimum Wage	24677737.9102	390926489.6954	0.0631	0.9500
Grain Production	52.4071	11.0212	4.7551	0.0000
1978 Egg Production	-0.1022	0.1912	-0.5349	0.5957

This regression shows much the same result as Table 16 because agricultural land and grain production were predicting egg production growth in much the same way so it would be expected that not expect much change in the regression output.

From this regression, one could begin making conclusions such as the majority of egg production growth from 1978 to 2004 took place in states that had large amounts of feed available. Feed availability is a measure of grain production, and intuitively also a measure of arable land because a state cannot have grain production without arable acres for cropping.

Taking the regression one step further one can eliminate all variables that are not significant leaving just 1978 grain production as a predictor of growth in each state's egg production.



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Table 16 - Regression based on 1978 state level grain production.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.60
R Square	0.36
Adjusted R Square	0.34
Standard Error	1443071324.38
Observations	48.00

	Coefficients	Standard Error	t Stat	P-value
Intercept	-261820164.7778	244944651.3743	-1.0689	0.2907
Grain Production	43.0901	8.5228	5.0558	0.0000

The regression in Table 16 demonstrates that 1978 grain production is the main effect of all variables included in Tables 14 and 15. This is evident because with all the variables removed the R^2 remains constant at approximately .3. Grain production alone does not entirely explain the variation in egg production growth from 1978 to 2004 but out of all the variables included in Tables 16 and 17, it explains 30% of the variation in egg production growth in 48 American states.

8.3 MODEL CONCLUSIONS

The conclusion that can be drawn from this particular model is that out of the variables included, a state's feed availability had the largest effect on egg production growth in the United States. Egg production tended to expand where there is more grain (and by necessity, more agricultural land). The reason for this pattern is intuitive. Feed grain is the main input into livestock product production and it is logical to locate near the source of the industry's largest input. However, more research is necessary to determine the other non-production factors that contributed to the changes seen in American egg production from 1978 to 2004. It is important to note that one of the main factors currently used to allocate Canadian egg quota, population, was not shown to be significant. The regression mathematically clarifies the correlations between change in egg production and the variables included in the model. The .3 R^2 value suggests that there are other factors than those listed in the above tables that are impacting egg production growth/decline in each state during the period.



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8.4 APPLICATION OF CANADIAN DATA

The results of applying Canadian data to the regression in Tables 15 & 16 are displayed below in Tables 17 & 18. Growth in egg production that would have occurred without supply management can be estimated using the coefficients for each factor. The difference between what the U.S. based model predicts and what actually happened to egg production in Canada is located at the bottom of Tables 17 and 18.

Table 17 - Application of Canadian data to regression in Table 15.

Category	Coefficient	Province				
		Alberta	Saskatchewan	Manitoba	Ontario	Quebec
Intercept	-227677682					
Environment	-121220502	0.86	0.411986812	0.78498321	2.600006123	2.510736664
Population	-44.44	1,438,500	677,100	752,200	6,407,200	4,834,500
Transportation	160909	1233	1820	2085	381	745
Unemployment	79697399	5.60	6.20	7.70	7.70	12.30
Minimum Wage	24677738	\$ 3.00	\$ 3.25	\$ 2.95	\$ 2.85	\$ 3.37
Grain Production	52	26,555,400	49,137,300	14,232,345	14,469,660	2,023,530
1978 Egg Production	-0.1022	507,744	251,424	647,568	2,342,304	930,528
Estimated Egg Production Growth		1,704,168,272	3,114,585,553	1,405,718,814	669,903,094	541,572,029
Estimated 2004 Egg Production		1,704,676,016	3,114,836,977	1,406,366,382	672,245,398	542,502,557
2004 Actual		526,596,000	269,976,000	981,096,000	2,623,068,000	1,217,796,000
Difference		(1,178,080,016)	(2,844,860,977)	(425,270,382)	1,950,822,602	675,293,443

Estimated Egg Production Growth is the regression's estimation of how much egg production should have grown during the period 1978 to 2004.

Estimated 2004 Egg Production is 1978 egg production plus the model's estimation of growth from 1978 to 2004.

2004 Actual is the actual egg production in each province in 2004.

Difference is the difference between the 2004 actual egg production and the model's estimation of 2004 egg production for each province.



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The regression calculation in Table 17 shows that all three prairie provinces have been disadvantaged by the actual allocation of Canadian egg production quota. It also shows that too much production has been allocated to Ontario and Quebec. According to Table 17 Saskatchewan has the largest deficit between projected and actual egg production of 2,844,860,977 eggs.

Table 18 - Application of Canadian data to regression in Table 16.

Category	Coefficient	Province				
		Alberta	Saskatchewan	Manitoba	Ontario	Quebec
Intercept	-261820164					
Grain Production	43.09	26,555,400	49,137,300	14,232,345	14,469,660	2,023,530
Estimated Egg Production Growth		882,452,022	1,855,506,093	351,451,582	361,677,485	(174,626,256)
Estimated 2004 Egg Production		882,959,766	1,855,757,517	352,099,150	364,019,789	-173,695,728
2004 Actual		526,596,000	269,976,000	981,096,000	2,623,068,000	1,217,796,000
Difference		(356,363,766)	(1,585,781,517)	628,996,850	2,259,048,211	1,391,491,728

Table 18 shows a slightly different result than in Table 17. The general conclusions in Table 18 are similar to Table 17 but the magnitudes differ. These differences emphasize the fact that econometric modeling involves estimates but is useful in analyzing trends and/or patterns. Table 18 basically draws the same conclusions as Table 17 except for Manitoba. Using estimates from the simple regression in Table 16, Alberta and Saskatchewan have a deficit between actual and projected while Manitoba, Ontario and Quebec have a surplus due to their being awarded too much production. Saskatchewan again shows the largest negative difference between actual and estimated egg production.

8.5 PREDICTION CONCLUSIONS

Both Table 17 and 18 provide similar information regarding Saskatchewan's allocation of egg quota. Although the model is based on 1978 production of wheat, corn and barley, it is intuitive that the growth in egg production is driven not only by beginning grain production but a constant or growing supply of grain within the region. One can see this by referring back to the U.S. data and states such as Iowa and Nebraska that had some of the largest egg production growth from 1978 to 2004 and largest beginning levels of grain production. These states are still some of the



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largest grain producers in the United States; much the same as Saskatchewan has maintained its grain production level from 1978 to present.

According to the econometric analysis above, quota allocation with some consideration for comparative advantage, specifically grain supplies as a factor of production in egg production, or the chief factor in grain production, land, would more closely follow production trends exhibited by the American market.

9.0 THE APPLICATION OF A POLICY ANALYSIS MATRIX

In the original proposal one of the evaluation tools to be explored was the Policy Analysis Matrix (PAM), made popular by Monke and Pearson (1989). As the research progressed focus shifted more to the explanation of growth in production rather than comparative potential profitability. Presented below is the basic methodology and potential output from this tool to fulfill obligations from the original proposal.

PAM has been used around the world to assess comparative advantage. It may not be directly applicable to these circumstances. It has most commonly been used to assess the comparative advantage of producing different final products using a specific domestic input, like an acre of land¹. PAM can also be used to compare different regions or production chains in the production of the same final good². Most often PAM is used to look at profit levels if government interference in a given commodity's price ended. Some new price would be expected and profitability would adjust among differing regions or between different input owners. In this sense comparative advantage is measured by profit. For example, regions that generate a higher profit from the sale of a given good, in the absence of price interference, would be deemed to have a comparative advantage in the production of that good.

PAM can identify what direction input and output price interference should go to improve the total real profit in an economy. Using the allocation of quota in Canada as an example, PAM has the ability to show which regions of Canada would benefit the most from increases in quota allocation and which would suffer the least from any reduction. Government intervention is not the only type of divergence between current prices and socially optimum prices. External costs like pollution can also be incorporated into PAM, so that comparative advantage is measured taking all of an economy's real costs into account.

The Policy Analysis Matrix (PAM)

The basic structure of PAM as described in Monke and Pearson is the matrix shown in Table 1. Note that the profit column is revenues less both costs for each line and the divergences row are all the private prices minus social prices such that $L=I-J-K$ and $L=D-H$. Social prices in the matrix are prices that would be expected without government interventions or externalities. In

¹ For an example of various uses of the same input, land, see Fang and Beghim (2000).

² For an example of comparing the advantage of one region or type of production over another in the production of same output, see Staal and Shapiro (1994).



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cases of government intervention that affects price, the open market price represents the social price of an output or tradable input. Domestic inputs that cannot be traded are valued at their opportunity cost or worth if put to the input's most profitable use.

Table 19 Components of the Policy Analysis Matrix.

		Costs		
		Tradable	Domestic	
	Revenues	Inputs	Inputs	Profits
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Divergences	I	J	K	L

Masters and A. Winter-Nelson (1995) present two measures of comparative advantage.

Using the variables in Table 19, they are: Domestic Resource Cost (DRC) = $G/(E-F)$ and the Social Cost/Benefit (SCB) = $(F+G)/E$.

In these formulas, G is the open market cost of goods used in production of one unit of a good that are associated with non traded goods, normally land, labor and capital. In most of the supply managed industries this would be all of the costs except the costs of feed and, where applicable, livestock purchased for further finishing. "Social" refers to the fact that these are the real costs after government subsidies/interference are taken out of the budget, but they could be used to include social costs like disease control etc.

F in Table 19, is an open market cost for traded goods used in production, usually a FOB port price in an open market backed off for transportation costs. E is the open market value of the unit of production normally an open market price adjusted for transportation. For example, the social revenue for a Canadian broiler could be an estimated open market price from the U.S. adjusted for appropriate transportation costs.

These comparative advantage ratios are basic profitability measures after adjusting prices to correct for government intervention. Higher social profits in a region would suggest a comparative advantage.

Estimating Interventions

It is argued here that the major intervention in the Canadian supply managed sector is the price of the finished good which is inflated by limiting supply to consumers and processors. Thus, the SCB as defined above would be current costs over an estimated open market price. Some adjustments on the input side could be included as long as data is available and it can be clearly shown that an input faces interference.



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One of the estimates this study would want to use for total cost is an implied cost of production, based on quota values (Q) and final prices (P). Total cost of production could be estimated by solving for costs (C) in the formula:

$$Q = (P - C) \left[\frac{1 - (1 + .04)^{-15}}{.04} \right] \quad \text{or} \quad Q = (P - C) 11.12 \quad \text{or} \quad C = P - \frac{Q}{11.12}$$

The formula assumes 4% for an interest cost and a 15 year amortization of quota values.

The measure of comparative advantage would be a ratio of this estimated cost (C) over the social price. In most of the estimates for this study this social price would be based on an open market price from a market, possibly the U.S., adjusted for transportation costs.

Data Needs

- The data needed for each of the sectors assessed would be:
- An openly trade price for quota (in the same units for each province) [**Q in the formula above**]
- The current price for the finished product under supply management [**P in the formula above**]
- The amount and cost of feed to produce one unit of production
- The cost of a young animal (chick or feeder) to produce one unit of production if applicable
- -Output consumed in each Canadian province and U.S. state
- -Output produced in each Canadian province and U.S. state
- -Land costs to produce one unit of production if applicable
- -Labor costs to produce one unit of production
- -Fixed assets required to produce one unit of production
- -A total of all other costs to produce one unit of production
- -The population of each province and for each state in the U.S.
- -The average income of each province and for each state in the U.S.
- -The price of substitutes for the sector assessed (e.g. for chicken substitutes could be beef and pork prices, and assume that milk and eggs have no substitutes) in each province and for each state in the U.S.

The first two data lines, quota value and current price, would populate the formulas above to estimate per unit cost of production.

The last three data lines, population, income and substitutes, would be used for a first estimate of an open market demand and supply for the finished goods. If these cannot be estimated with any confidence, the model can also use averages from the U.S. Most of the other data would be used to populate the matrix as described in Table 1.



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Potential Output

This methodology should yield social profitability measures for each region of Canada and for each supply managed sector. The methodology also suggests that comparing province's Social Benefit Cost (SBC) ratio as the key comparison based on the arguments of Masters and Winter-Nelson.

Using this ratio one could tell which region was most likely to capture social benefits from an increase in quota allocation. The reader should take caution, however, that PAM can only suggest which direction an adjustment should go. The absolute size of the adjustment should not be based on PAM because it ignores factors like the overall size of a market in a given region and may ignore shifts in regional supply and demand as intervention is reduced.

In summary, PAM is not further explored in this study but is an area that merits additional consideration for identifying the comparative advantage of production in regions of Canada through profit and cost analysis.

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10.0 SUPPLY MANAGED PRODUCTION OUTSIDE THE SYSTEM

As one looks at the regulatory and legal hurdles to the production of supply-managed commodities outside the supply-managed system for export, one must also consider the history and success of the supply-managed system for the producers, consumers and, of course, the financial and public health of society in Canada. As well, if changes to the system are to be considered, one must also take into consideration the effect that those changes might have on every aspect of the system as it presently exists.

First, we shall review how the supply-managed system works today for the production of dairy, egg, poultry and broiler-hatching eggs. Through the National Farm Products Council (NFPC) for eggs, poultry and broiler-hatching eggs and the Canadian Dairy Commission (CDC) for dairy, the legislation provides for the industry to determine the quantity of raw product to be produced each year in order to fulfill the domestic requirements with, in some cases, consideration for market development production.

Through the NFPC and CDC, means have been determined to calculate the production quota required to fulfill the needs of each commodity and the quota is then allocated to the province or territory. The national body (either NFPC or CDC) monitors and enforces production on a national basis but it is the role of provincial commodity boards to allocate the provincial quota within the province. In every case, provincial regulations require production to be marketed through the commodity board with quota allocation to allow the production.

There is clearly a linkage between the federal and provincial governments in the marketing of dairy, egg and poultry production but it is the provincial commodity board regulations that manage the distribution of quota within the province and it is also the commodity board which enforces the fact that quota must be obtained in order to produce. For example, in the case of egg production, the commodity board may allocate their federally determined provincial quota to producers for the production of eggs for different uses such as commercial (households, restaurants, etc.), eggs for processing or export market development. In every case, quota must be in place to allow the production. It is therefore clear that production outside the commodity board regulations is not allowed by law.

Domestic legislation and regulations requiring quota for export trade

Under section 4(1) and 7(e) of the Canadian Egg Licensing Regulation, 1987, no person shall engage in the marketing of eggs in interprovincial or export trade unless that person holds an appropriate license and unless these eggs have been produced by a producer authorized to do so under a federal quota allotted to the producer pursuant to the Canadian Egg Marketing Agency Quota Regulations, 1986.

Section 4 of the Canadian Egg Marketing Agency Quota Regulations, 1986, provides that no producer shall market eggs in interprovincial or export trade unless:

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- a) A federal quota, egg for processing quota or export market development quota has been allotted to the producer, on behalf of the Agency, by the Commodity Board of the province in which the producer's egg production facilities are located.
- b) The number of eggs marketed does not exceed the federal quota, egg for processing quota or export market development quote referred to in paragraph (a)
- c) The producer complies with any subsisting rules of the Commodity Board referred to in paragraph (a) that the Commodity Board has been authorized by the Agency, pursuant to subsection 22(3) of the Act, to apply in performing on behalf of the Agency the function of allotting and administering federal quotas, egg of processing quotas and export marketing development quotas, etc.

In summary, the Canadian Egg Licensing Regulation, 1987 and the Canadian Egg Marketing Agency Quota Regulations, 1986 provide that eggs marketed for export must have been produced under quota.

Is there any way that exports, for example eggs, can take place out of a province?

The only way would be for the province to allocate some of its federally assigned quota for such a purpose but, even then, the experience of the dairy industry with commercial export milk (CEM) in 2000 and the resulting challenge to the WTO would in all likelihood come into play.

In the case of the CEM, the WTO panel determined that there was cross-subsidization occurring and that therefore, in their view, transactions around the CEM program involved "payments" on the export of products and that these payments were financed by virtue of government action" i.e. our supply management system of supply and pricing. Due to the higher price of milk to Canadian consumers, the CEM program was able to export milk at a reduced price because the price reduction. This price reduction was made possible because the decrease in revenue was being made up in the domestic market.

However, there are those who propose and argue that the creation of a separate export industry, nationally or provincially, comprised entirely of non-quota holders could be consistent with Canada's WTO obligations if a number of conditions were met.

In order to have any chance of being successful with this approach, a non-quota holder exporting product would have to do such things as:

- Cut any links between themselves and government actions.
- Finance their transactions directly between themselves and the processor – not the commodity board as is the case with quota holders.



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- Ensure that non-quota holders have no relationship with operations operating under quota
- Recognize the questions that could be raised regarding the degree of separation between the quota production system and a non-quota production system even in areas such as transport and processing.
- Recognize that, if it is deemed that non-quota holders were selling below that average cost of production and might trigger government payments, there could be a WTO challenge whether that be one of countervail or anti-dumping.
- Recognize that, if the creation of a non-quota holder production system was to occur and the sale of its product was limited to export, any payment for any reason by government to those producers could be considered by some to be an export subsidy. However, this might be somewhat diminished by the fact that the Canadian programs of support are whole farm and not commodity specific.
- Recognize that, if a non-quota system were to be implemented, then the policing of the production to ensure it all went to export would also be a requirement.

If a system were to be put in place for non-quota export production that could meet as least all of the above concerns, probably a greater concern would still have to be dealt with and that is the peer pressure by quota-holder producers in the province and across Canada as a result of their fear that a non-quota system would "blow up" the well-established and successful domestic supply management system presently in place. There may also be pressure from Canadian consumers to lower domestic price. Arguments would stem from a feeling of injustice that under such a system foreign buyers would receive a deep discount for the same product available to Canadian consumers at a much higher price.

An international concern related to the export of supply managed goods is possible charges of dumping. Anti-dumping trade law states that no nation can sell their product in global markets for less than its cost of production. This has become a concern to Canadian industries in recent years considering allegations by the US of Canada dumping wheat and hogs into the US market. One can be certain that if Canada were to export any sizable portion of its supply managed product to the US, dumping allegations would follow. Canadian domestic prices are based on public cost of production studies and it would be very difficult to argue that export prices below these calculated costs are not below the cost of production.

In looking at current breaking egg exports to the US, volumes are low enough to not attract US attention. However, a move to increase these exports would attract US attention. All Canadian eggs are produced within the supply managed system and the high domestic price could be viewed as subsidizing current exports as well as any expansion to export volume.

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Some comments on the U.S. Farm Bills (2002 and 2007) and the WTO

There is no question that the 2002 Farm Bill was written in a time of budget surplus and foreseeable surpluses in the ensuing years. That has all changed as has the increasing pressure, especially from developing countries, at the WTO. President Bush did try to cut funding for farm programs in 2002 Farm Bill last spring but was not successful. However, the president has already given a warning that, due to budget deficits and international pressure, American farmers better get ready for a serious attempt by the government to reduce farm spending.

In my view, there may not be a reduction in total dollars to farm support but the support may be given in ways different than in the 2002 Bill (i.e. for conservation, environmental and food safety issues) all more readily supported by the public than the cheques that go to a small percentage of American farmers, those mostly being very large operations.

It will also be of interest to see what happens to the "Country of Origin" approach taken by the U.S. It has "rested" beyond the 2002 Bill suggested action date. Will it be resurrected or die?

Through the WTO process, the U.S. needs export markets for their tremendous production but they are not likely to get that market access unless they cut the subsidization to the very products they need or wish to export. The recent WTO panel ruling on the U.S. support to cotton is an example of how many feel. Also the apparent desire of the U.S. to ignore panel rulings is wearing thin in the international community, e.g. softwood lumber from Canada.

A question could be raised: Do they care about what the world thinks of their approach? If not, how long before some, or many, "take a run" at them in some way such as retaliation?



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11.0 POLICY RELATED TO COMPARATIVE ADVANTAGE CONSIDERATIONS

Historically Canada and the provinces have agreed to implement the joint federal provincial marketing plans for supply managed industries. The Territories were left out in the first plans. Since the inception of the CEMA plan from 1972 onwards, some changes have been seen to recognize the policy gaps.

Some of the key issues include:

- 1) The allocations were made in a "back-ward" looking historical manner and did not consider the future and market growth/ technology considerations, or comparative advantage/ economic criteria (as conventional economists would define). The deficiency of the approach is to ignore the internal growth patterns of Canada. It provides a licensing process for Canada within each province to derive internal benefits under the GATT and now WTO umbrella. At that time of setup, policy makers did not understand/ acknowledge the integration of Canada with the USA economy in other sectors through the CUSTA, NAFTA and the role of the agriculture sector within the new WTO. The further integration of Canada into a global market place will see other changes and challenges. The SK challenge can result in a scenario of system overproduction, if they choose to oversupply in the near term to make a point/ or choose to leave the system. This would cause producer prices to decline as happened before with chicken. From time to time this issue has arisen with production outside the system (BC milk) and in assessing the costs and benefits of staying in the system (AB and BC- 1985 reviews). The Alberta Hatching Egg Board is currently outside the system due to these issues.
- 2) Lack of inclusion of all parties- The lack of inclusion of the NWT and other territories in the national plans was a gap, realized from 1988 onwards. This led to reviews of the potential allocation for the Territory and has since resulted in an allocation to the NWT for chicken and egg production (to be checked for actuals)
- 3) Productivity gains, surplus product and product innovations- Another policy gap realized was the development of surplus milk production resulting from higher productivity of milk cows and overall increased milk supply. This caused the CDC to ship surplus milk powder into export markets and has caused the USA to bring actions against the CDC. Currently this is still an issue under the WTO consideration and is being challenged by the USA. It will see some resolution in the upcoming Ministerial round. Similarly the innovation/ development of larger broilers means that fewer hatching eggs are needed (now down to 85% utilization in AB). Also the advance of new product innovations from processors with substitute products (eg Soy milk) shows the need for comparative advantage to include innovation and product development. Provinces and states, which demonstrate these innovation capacities in response to consumer demand, illustrate competitive behavior and an emerging comparative advantage.



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- 4) Population and Market Growth - Consumption of chicken has been rising in Canada over time from 19 kg in 1971 to about 34 kg currently. This is a dramatic rise compared with beef and pork. Beef has been generally declining from 40 kg in 1971 and is now at about 31 kg. In 2003, beef demand shot up by 60% due to the beef BSE crisis and subsequent promotion to aid farmers and positive consumer response. Pork demand has been declining since 1971 (at 32 kg) and is about 29 kg currently.

In the USA, poultry consumption is higher mainly due to lower prices and broader availability. In the USA poultry meat consumption has risen from 22 kg in 1971 to 49 kg, or more than two times.

In Canada, total meat consumption is about 96 kg per capita, of which poultry is 35%. In the USA, meat consumption totals 126 kg per capita of which poultry is 39%. Thus Canadian poultry products have the opportunity to capture a huge increase of latent domestic demand, given new products and appropriate pricing. If chicken consumption was at USA levels, this would be an additional 900 m kg of product. This is part of the reason for the differential growth concepts in AB- how to respond to internal demand (latent) growth. Egg consumption may also realize similar demand issues.

- 5) Food Processing and Import replacement needs- as the consumer market change to more food supply chains, this will have an impact on the role of "qualified supplier farms." The next generation of farming will likely develop in to five main types:
- Commodity farms- which are producing main grains, livestock and fruit and vegetables but selling into commodity markets
 - Niche farms- which sell limited quantities of products
 - Qualified supplier farms- to meet certain protocols from the processor/ manufacturer – this will coordinate the production/ processing along a chain
 - Direct sales and Agro-tourism opportunities- for smaller farms serving the urban market seeking experiences and rural based opportunities.
 - Farms with off-farm investments/urban investments and diversified investments in allied companies- to ensure future growth opportunities exist. This will provide new sources of resources.

As food processors and food service expands in Canada, more food supplies will be required for new ethnic foods and different meal solutions. These innovations will develop into new ways to sell more product. How will the SM-5 chains respond to allow this advantage to be realized?

- 6) An export product example for competitive growth from chickens exists. Canada manages its imports and exports under the Department of Foreign Affairs through an Act. The Export and Import Permits Act (EIPA) of AAFC provides the authority and details for the importing of specific products into Canada. See: <http://www.dfait->



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maeci.gc.ca/eicb/notices/ser664-en.asp for specific details on the process and guidelines.

Agriculture and Agri-Food Canada has the agency authority to manage the imports of these items. *"Import Control List pursuant to paragraphs 5(1)(a) and 5(1)(b) and section 5.3 of the Export and Import Permits Act (EIPA), in order to implement a Canadian commitment under the World Trade Organization (WTO) Agreement on Agriculture."* The Import Control List is the product list developed under the Canada- USA Free Trade Agreement.

Clause 5.6 This Clause provides for the Import to Compete Program which allows importing of dark chicken meat.

"Manufacturers who have been issued an import allocation for production of chicken and turkey products that are not on the Import Control List (ICL), also referred to as "FTA quota", will normally be required to have exhausted this allocation before supplementary imports may be authorized under this provision. An allocation will be considered exhausted only if all permits issued have been used and the allocation balance is zero.

Manufacturers applying to the EICB for import permits for chicken or turkey under this provision must state the quantity and the specification of the product to be manufactured and the anticipated production and delivery dates."

Clause 5.7 allows for the Import for Re-Export Program- IREP. This program allows food manufacturers to import chicken and re-export to other countries.

These clauses allow for importing of raw product for developing of new chicken products and markets. However, this also shows the deficiency of the current regulated system to allow for domestic processors to innovate and develop these niche product applications.

- 7) WTO emergence in Agriculture and Agri-food- The WTO (GATT) in 1995 realized the first agreement on agriculture and addressed a number of concerns including (Toma and Bouma, Action After the GATT, 1995):

- tariff reductions and market access enhancement;
- export subsidies reduction;
- domestic market support reduction;
- sanitary and phytosanitary measures usage; and
- a peace clause.

Since that time, the main issues relevant to SM-5 are phytosanitary measures and market access. One of the recent agriculture issues are the human health risks from animal diseases like BSE and Avian Flu.



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BSE was discovered in Alberta in one animal in May, 2003 and the border was closed immediately by the US and other countries. The events since then have seen the US restore the market access to specific meat products of beef animals younger than 30 months of age from Canada effective September, 2003. A number of other countries have similarly opened their borders to Canadian beef. Japan however continues to not accept Canadian beef products. The costs to that date for the Canadian industry were estimated at nearly \$2.5 billion.³ It is now acknowledged to be over \$6-7 billion. A second case of BSE in North America was discovered in December, 23 2003 in the US state of Washington with an Alberta-born dairy cow. This second event also caused many foreign governments to ban the imports of US beef. Two more cases have been identified. The new opening of the USA border to live cattle shipments of over 30 months shows this is a difficult trade issue.

Avian Flu disease is affecting chicken populations and consumers in Asia. Governments are in process of killing many flocks to control the disease and prevent its transmission to humans. In BC a major kill was implemented to address the disease and Alberta had to increase local production to provide continued supply.

Further, the issue of feeding animal parts to poultry in the feedstuffs (is permitted still in Canada and the USA), is an underlying issue for consumer confidence. Whether this is proven out in reduced per capita consumption over a longer term is not yet known.

Taken together, risks (trade) related to animal diseases are real and may be long-term. The links of animal diseases with potential risks to human health are evident and are being taken seriously by governments around the world. Japan is very wary of the BSE disease and is likely to be reticent to opening its market to imported beef without substantial changes in production and inspection being implemented by supplier countries recording incidences of BSE. The Avian Flu is a current issue that can be contained more easily in a low population area of Canada.

The effect of these animal disease and human health events on meat consumption (of both chicken and beef) will be business and trade risks that the animal protein industry will need to address. How these events will impact investment decisions for production and further processing remain to be determined.

The next round of the WTO negotiations (December 2005) are to conclude with some form of agreement. How this will impact SM-5 and state trading enterprise (among other issues) is not yet clear. The scenarios are likely (Toma and Bouma, presentation to Wild Rose Agriculture Producers, January 2005):

- State trading enterprises will have disciplines on financing/ market distortions- the CWB will need to reduce its financing loans to 6 months or less and they are in process of adapting

³ Serecon Management Consultants, 2003.

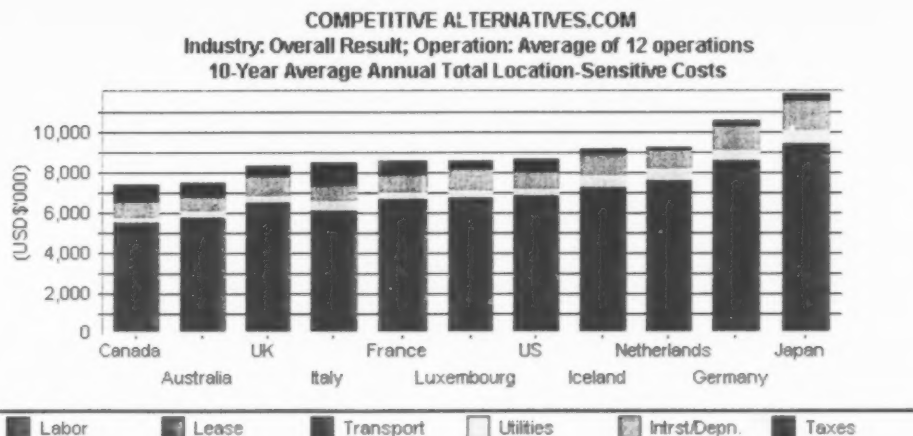
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- Exports- CDC- dairy has to reduce its export market scheme of skim milk substantially.
 - Market Access- Other products will see Canadian tariffs by a certain amount (last round was 36% from a base) reduced over a five year implementation period and the levels are not yet known. The TRQ will also rise to increase market access by specific country. The last round offered up minimum market access to the USA of 7.5% and it is likely that that level or more may result.
 - Export subsidies- will see some disciplines to reduce gross national levels but it is not clear how the EU and the USA, will come to agreement on the levels and five year targets.
 - Canada is alone on the SM-5 issue as others have export subsidies, market access etc as more important issues. The issue of benefits to the 148 participant countries- less developed is being questioned.
- 8) Internal Trade Agreement- in Canada a number of internal trade barriers still exist which prevent trade among provinces as freely as between Canada and other nations. A new federal initiative is under way to try to resolve these issues. If the final implemented IPT agreement allows for trade among certain resources this may impact comparative advantage conditions for consumers and processors. The SM-5 industries are part of the issue and how comparative advantage is incorporated within the ITA is not clear. CEMA recognizes this issue and deals with it through quotas and levies.
- 9) International Comparisons
- Canada's competitive cost advantage across 12 major industries is illustrated in the Figure below. This analysis is based on location sensitive cost research conducted by KPMG LLP for 12 major industries in several countries.⁴ In KPMG's 2004 report, Canada shows comparative advantages (low cost leader) despite the recent appreciation of the Canadian dollar versus the US dollar during 2003.

⁴ KPMG LLP. www.competitivealternatives.com. Competitive Alternatives is a guide for comparing the impact of 27 business cost components that vary by location, as applied to specific business operations. Research in 2004 covered more than 85 cities in Austria, France, Italy, Germany, the Netherlands, the United Kingdom, Canada, the United States, and Japan. The basis for comparison is the after-tax cost of start-up and operation for 12 specific types of business, over a 10-year time horizon.

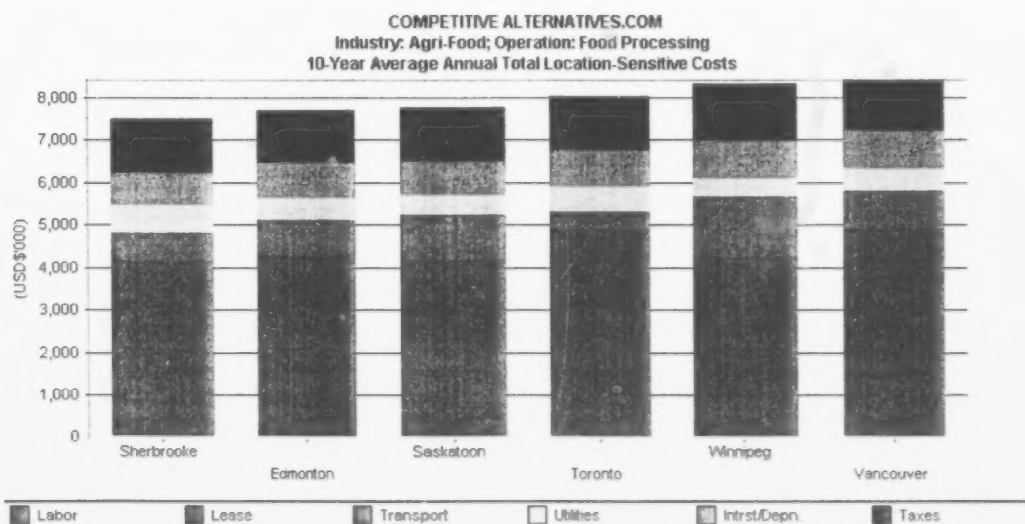
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Figure 2 - Location Sensitive Costs in 12 Industries – 2004



The potential cost advantage for a food manufacturer locating in Canada compared to other locations in Canada and United States is illustrated. Salary costs for labour, management and administration are seen to be the largest contributor to manufacturing cost in all the locations shown. Locations within western Canada appear to be very competitive from the labour cost perspective and likely other main investment items.

Figure 3 - Location Sensitive Costs in 12 Industries – 10-Year Average



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10) Comparative advantage summary policy considerations- as Canada continues to develop its industries, global competitiveness will drive global markets including food markets. Policy considerations include:

- WTO impacts- what will they be? What is the implementation timeline?
- ITA- for provinces to have full access to new FD investments and private sector investments, will need adequate raw materials. One of the barriers to further processing and food service expansion is the SM-5 system which is at odds with the ITA concept. Will this change significantly?
- Investment costs and operating costs- such as land, buildings, labor, human health risk, environmental costs/ risks, feed, utilities, transportation
- Provincial quota values- is this a reflection of comparative advantage? Currently hatching egg quotas are BC- \$108/ bird, AB- \$120/ bird and SK-\$75/ bird.
- The PAM model noted contemplates both of the above economic costs in the analysis of national comparative advantage
- Provincial resource value adding is constrained under current conditions. Provincial value adding and innovation can drive further economic growth and is acknowledged as the global trend need in responding to consumer markets. If a concept of differential growth or processing driven growth resultant from FDI or DDI (foreign direct investment or domestic direct investment) then the supply base for further allocations can follow. A variety of SM-5 quota allocation schemes are in place from a 50/50% historical/ new population to 10/90% historical/ new population formula. Allocation formulas are not harmonized across industries within the national frameworks.
- Differential growth – these concepts as supported, would presumably allow investments to be made by the processing sector into appropriate locations and the allocations will follow thereafter. Alberta is seeing expanded demand and imports of eggs have been increasing and the province is short about 300,000 birds (table eggs). The concept of differential growth is a relative measure and appears to be supported by Professor Joel Bruneau of the University of Saskatchewan concurs with the assessment of the meaning of comparative advantage as set out in the Saskatchewan paper of April 2003. He is of the opinion that comparative advantage is always discussed in relative terms. (CEMA paper).
- Importantly, a successful comparative advantage definition will incorporate both historical and "forward looking" economic criteria. Forward looking criteria have not been used to reflect the rise of supply chains, product innovations, retailing, productivity and processor needs. The criteria are important to consider and discuss. General economic definitions will primarily rest on COP, market and financial criteria and are well demonstrated in other industries. The KPMG graphs indicated how Canada is a low cost location and the Canadian west is a low cost location for agri-food processing. Economists may not be able to satisfy decision makers with strictly economic criteria.

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- Meshing of the weight losing industries concept/ investment goals and the differential growth (being considered) can be a model/ base to start from. (Note the completed regression supports this direction. "According to this choice of variables, population is the only factor that has any bearing on where and at what level egg production takes place. Egg production tends to take place where there are more people. The reason for this pattern could perhaps be explained by demand, similar resource requirements (water, climate etc) or labour availability". We may develop an economic model to show how prospective regional gross benefits/ revenues develop from the comparative advantages (costs and opportunity costs) and can be the place to start forecasting/ projecting the implications for provinces for overbase quota. From here the quota allocation approaches (and perhaps portability concepts) to reflect population growth and the next decade's demands for new food products and processor demands from differential growth can follow. This is the second key issue to assess for decision-making.

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12.0 CONCLUSIONS AND RECOMMENDATIONS

Comparative advantage exists in Saskatchewan mainly due to the province's abundance of vast areas of agricultural land. The large land base and sparse population creates comparative advantage of production for various production factors such as abundance of feed grains, bio-security and land application of manure. Urban pressures for land in Saskatchewan are minimal thus enhancing the province's comparative advantage due to low opportunity cost of using land for agricultural purposes. Higher value alternatives do not compete for land to the same extent as in other urban pressured areas of Canada such as Ontario and Quebec.

The existence of comparative advantage of production in Saskatchewan can be evidenced through a proxy industry analysis of the development and growth that has occurred in the hog industry. Because of the similarities between different types of intensive livestock operations, one can conclude that the comparative advantage of production that exists for hog production would also exist for supply managed intensive livestock industries.

The existence of comparative advantage is also evidenced through a direct comparison of the egg industry between Canada and the United States. Under the assumption that Canada and the United States share similar production environments, one can conclude that under a similar environment lacking policy intervention, Canada's egg industry would have grown similarly to the American industry. Considering the similarities between Saskatchewan and Nebraska and Michigan and Ontario, one can conclude that egg production in the Canadian provinces would have followed the development patterns of their companion American state. Accordingly, the growth patterns in the United States can be attributed to comparative advantage and the related factor endowments utilized in egg production and abundantly, and similarly, available in Saskatchewan and Nebraska.

Although comparative advantage is most often referred to within open market assumptions, it can also be applied to production and markets that are influenced by government policy; specifically supply management. Using egg production growth data based on the American egg industry, an econometric analysis indicated that grain production and intuitively land availability were factors in determining the growth of American egg industry. Using this information, it is possible to develop a framework within the supply management system that awards quota based on comparative advantage of production considerations.

Application of the econometric model as presented in the report is possible through applying the relative levels of production that were calculated by incorporating Canadian provincial information into the econometric model. Calculated production levels could not be directly transferred to production quota levels, as they do not fall within national supply managed limits. However, each province's percentage of total calculated production could be prorated against current provincial quota allocations.



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To further evidence the existence of comparative advantage, the application of the Policy Analysis Matrix should be explored for purposes of identifying the comparative advantage of production in regions of Canada through profit and cost analysis.

Comparative advantage of production can also be applied outside the supply management system. For example, if Saskatchewan were not able to expand production of commodities within the supply management system, expansion in these industries could occur through export markets. Saskatchewan's comparative advantage of production is not only a valid consideration within Canada, but potentially also on the international export market. However, policies limiting expansion into these markets for supply managed industries currently limit Saskatchewan's ability to take advantage of its production advantage outside the current policy environment.

The province of Saskatchewan should be mindful of World Trade Organization negotiations that are currently taking place, as outcomes to these discussions could adversely impact on any decision to expand production of supply-managed commodities designed for export internationally.

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APPENDIX A

MAP OF ESTIMATED TOTAL LIVESTOCK MANURE IN CANADA





